APR 25 1922

VOL. XC. No. 2316. [All Rights Reserved.] APRIL 14, 1922. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] PRICE SIXPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. 4. SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £2 1s. 6d. per annum.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
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THE

ELECTRICAL REVIEW.

VOL. XC. APRIL 14, 1922. No. 2,316.

ELECTRICAL REVIEW.

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"ELECTRICAL REVIEW" SUBSCRIPTION RATES.

UNITED KINGDOM	£1	14	8 per annum.
CANADA	1	12	6 do.
COLONIAL and FOREIGN	2	1	6 do.

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INDUSTRIAL PSYCHOLOGY.

IT would appear probable that the financial condition of the country, which prompted the Government last year to curtail the extent of its contribution to industrial research, has resulted in greater efforts on the part of industry itself. The first anniversary meeting of the National Institute of Industrial Psychology was held at the Mansion House, London, on March 27th, when Mr. H. J. Welch (chairman of the Institute) presided, and the meeting was addressed by Viscount Haldane, Mr. W. L. Hichens, and Dr. C. S. Myers, F.R.S. (Professor of Applied Psychology at Cambridge). A feature of the speeches was an appeal for funds, not only for the purpose of carrying on research, but also for investigating the practical application of the results.

The Institute was formed a little more than a year ago, and it will be remembered that it was in January, 1921, that the Industrial Fatigue Research Board received a provisional notice from the Medical Research Council that the Treasury could not contemplate the continuation, after March 31st of that year, of the financial provision previously made for the work of the Board, and a request that steps should be taken by that date to transfer any important work to the independent support of industrial or other voluntary associations. As the result of strong representations by the Board, however, steps were taken by the Council to ensure the continuance of the work, which enabled the Board to avoid the sacrifice of many valuable data that had been collected, and permitted it to undertake fresh investigation, although on a more restricted scale than previously.

The objects of the National Institute of Industrial Psychology, as explained by the chairman, are to assist employers in finding the best way to do each piece of work, and, in addition, to help employers to find the best worker for each class of job, and the best job for each worker. The way in which the Institute is going to do this is by bringing to the assistance of the employer the latest scientific knowledge and the advantage of scientific training. It is claimed that the application of science to fatigue research, motion study, vocational selection and training will do what is most important at the present time, namely, help to increase output; it will reduce unnecessary fatigue, and add directly and indirectly to the happiness and well-being of the workers, although the cynic may perhaps be pardoned for reflecting that things seem to have gone from bad to worse since industrial psychology has been taken so seriously here.

Many eminent scientists and industrialists are among the members of the Institute, and it is a good thing that this should be so, as both the scientific and practical sides are represented. It is important to note that at the

meeting it was announced that Dr. Myers would retire from his Chair at Cambridge as from June next, in order that he may devote the whole of his time and ability to the work of the Institute. Dr. Myers has done much valuable work for the Industrial Fatigue Research Board, and has carried out a great deal of research in the direction of improving the lot of workers, and incidentally improving the working of a factory from the employer's point of view.

Dealing with some of the investigations being carried out by the Institute, Dr. Myers said that these included the arranging of materials in the best positions, the training of backward workers in the best methods, determining the most suitable distribution of rest pauses, vocational selection, &c., and by such means the Institute had already increased the output of various departments in certain factories by from 20 to 40 per cent., whilst incidentally decreasing the fatigue of the workers. Tests for certain classes of workers have already been formulated, as has been done to a larger extent in America, and in Germany. We have heard so much in the last few years with regard to psychological investigation that there are many who are beginning to doubt that it will lead us anywhere, but a move has been made by the Institute in the direction of sending trained psychologists into various factories, the results of whose work have proved to be highly satisfactory, from the point of view of both employers and employed. If the confidence of the workers themselves can be gained, it is a great step forward, because it has long been recognised that the suspicion which rests in the mind of the worker today is a stumbling block to the establishment of better relations between employer and employed. Mr. Salmon, of Messrs. J. Lyons & Co., who employ some 20,000 people, spoke of the great advantages which had accrued to his firm as the result of the efforts of the Institute. By the application of scientific knowledge, the firm has been shown how to handle its goods to the best advantage, and the manual staff has been able to handle 30 to 35 per cent. more goods, with less physical effort. Numerous instances could be quoted in which particular firms have benefited, and it is the intention of the Institute not to forget the practical side of the subject.

A resolution was passed at the meeting pointing out that a more complete and scientific development of the nation's human resources and a reduction of wasteful and misapplied energy are matters of urgent national importance; that the methods adopted by the Institute have been shown to reduce costs of production, to promote the development of individual ability, to eliminate unnecessary effort and fatigue, and to improve the health and well-being of the worker; and that it is imperative that a national fund should be immediately established to enable the Institute to extend its sphere of usefulness and to continue the necessary researches into the scientific problems involved. It is a very complex problem, however, and not one which it is easy to get employers to take sufficiently seriously, especially in times of trade depression, and it is well that we have such enthusiastic workers as those who are trying to further the interests of the Institute.

The Electricity Supply Bill.

The outstanding feature of interest last week for the electricity supply industry was the passage of the Electricity (Supply) Bill through the Committee stage in the House of Lords. For days before the fateful Tuesday, a formidable-looking load of amendments had gradually accumulated—amendments of all sizes, big guns and little guns, some indeed warranted to sink the ship. And when the Tuesday evening debate began, this formidable artillery reverberated ominously in the opening strategy of the Marquess of Salisbury. Like the fat boy in Pickwick, he made our blood run cold as to what might happen if the House were temerarious enough to expose itself to the proposed attack instead of taking cover under a "Select Committee." And then the unexpected happened. "All went merry as a marriage bell." There were a few faint-hearted whoops of old war-cries, but they quickly died away under pressure of Lord Peel's suave, business-like handling. In a couple of evenings the whole batch of amendments was disposed of without the noble Lords having to work after dinner. Various factors contributed to this satisfactory conclusion. First of all, the Lords seemed in no temper to stand any of those vague fulminations about colossal expenditures, with regard to which one of our esteemed financial contemporaries distinguished itself; and Lord Peel's quiet, reasonable common-sense became contagious, resulting in a give-and-take policy which delivered the whole debate from any touch of rancour. In this connection we certainly think that Lord Peel, and presumably the Electricity Commissioners as his advisers, adopted an attitude which was irreproachably conciliatory. Whenever a concession could be made, Lord Peel seemed anxious to make it. We do not mean that everyone had what he wanted, or that everyone had what he ought to have been allowed, but there was obviously a great desire on the part of Lord Peel to square the Bill with every interest so far as he could see his way to do so. He was firm enough when necessary, as when he would not listen on principle to any amendments based on injury (real or imaginary) to the gas interests, and uncompromisingly denied a *locus* to gas *quâ* gas. Altogether, therefore, all parties came through with general credit, and we hope that when the Bill is submitted to the House of Commons, the same business-like dispatch will characterise its passage.

Salesmanship Conferences.

The salesmanship conferences organised by the B.E.D.A. during the session 1921-22, came to an end on Friday, March 17th. The conferences have been really helpful to those taking part in them, and the feeling of the meeting was reflected in the words of Mr. Young, a contractor, who proposed a vote of thanks to Mr. Beauchamp, Director of the B.E.D.A., for the able manner in which he had organised them. Mr. Young said that the gatherings had been a great help in raising that enthusiasm which had been so often mentioned as a necessary quality in a salesman, and that they had been a big force behind the endeavours of many during the winter. The interest which has been taken by the industry is exemplified by the large number attending and by the keenness with which they have entered into the discussions. Indeed, serious consideration was given to the suggestion made during the course of the session that accommodation for a larger number should be obtained, and at the fourth lecture, acting upon the advice given by various speakers, the meetings opened half an hour earlier in order to give more time for discussion. The conferences were organised as an experiment, because it was felt that many of those engaged in selling electrical goods had had no real training in salesmanship, although they had spent years in learning the technique of the business, and that by getting together and talking on salesmanship some good might result. So successful a session must of course be followed by another series of conferences next winter. Perhaps they will be on a more ambitious scale, and, as was originally hoped, they may extend to the provinces.

A good deal of the discussion at the last conference turned on the policy of manufacturers of electrical apparatus with regard to supplying the public directly. This subject is always interesting. On this occasion one well-known manufacturing company, the day before the conference, announced that it would not sell direct to the public at a discount. It is a well-known fact that electrical contractors not unnaturally feel very deeply on this matter. It was stated at the conference that some firms supplied direct to the public, and that in six cases out of ten discount was given without question.

Cases were quoted by contractors in which they had estimated the cost of wiring premises and supplying the necessary fittings, but had been subsequently told by their clients that they could get discount by purchasing direct from the makers. This is cutting the ground from under the feet of the contractors, who regard it as a short-sighted policy on the part of the manufacturers, which will re-act upon the latter. The manufacturers' case was put forward by their representatives at the conference, several of whom stated that they had showrooms primarily for demonstrating their goods, especially when they were of a specialised nature, and that when a customer made a purchase and paid cash he was asked for the name and address of his contractor, whom the manufacturers credited with discount.

If such a policy were general there is no doubt that it would be to the advantage of all concerned, except perhaps a few purchasers; but there are difficulties, in that some buyers falsely represent themselves as contractors, and in some cases a buyer has not a contractor, because he may have moved into a new house in which he is using electricity for the first time. To get over this difficulty it was suggested that if contractors were to co-operate for the purposes of providing better facilities for advertising and demonstrating electrical goods, the discount could be paid to the town from which the purchaser came, and each contractor would get his quota, but this involves a much bigger question, and is a matter of time. Competition on the part of supply authorities was also touched upon, but it was pointed out on their behalf that they were not a bit interested in the sale of apparatus, but merely looked upon them as a means to an end.

All things considered, it is evident that the contractor is beginning to come into his own, and that manufacturers and supply authorities alike are showing a willingness to extend to him that consideration which he considers is his due. For the contractor it must be said that he is not slow to recognise it, if the remarks at the E.D.A. conference are any indication. Unless there is co-operation between the supply authorities, manufacturers, and contractors, there cannot be that full development of the uses of electricity which is possible.

University Training for Industry.

We were pleased to note in a recent issue of the *Bulletin* of the Federation of British Industries a questionnaire circulated to its members on the subject of University Training for Industry.

Addressed to all trades, the questions are necessarily somewhat general, and they invite opinions on the value of University education to industry, and its possible development; co-operation between the trades and Universities for purposes of research; and the best curriculum and general views and suggestions are invited. The blunt question is also put—Are University Graduates better fitted for responsible positions in trade than those who have not had such training?

Our own views on the subject as applied to the engineering industry are fairly well known to our readers.

Except in the rarest instances, no man can achieve important results in engineering to-day without a thorough scientific training such as can only be obtained at the Universities, new or old. We go further, and say that a man who aspires to make a name in engineering must undergo an intensive training in science to the exclusion of dead languages if he is to begin his career at a reasonably early age. Life is not long enough to enable any but an exceptional man to become first a classical scholar and afterwards a scientific man. And in our opinion anything short of scholarship in the classics is largely waste of effort even from a classical point of view. Two modern languages are desirable in addition to good English.

Engineering now embraces so many branches of science that a man's whole time and thought must be given up to it from the age of 16 to 21 or 22, and if in that period he can sandwich in a part of his practical workshop training as well, he will be lucky.

The day of the "rule-of-thumb" or practical man is over, except, as we have said, in the rarest instances, where natural genius and extraordinary energy enable a man to teach himself as he goes along. The day of the "well-educated" youth who knows little of science and nothing of practical engineering, never existed, and never will in our profession.

In some brnches of trade, no doubt, a "liberal education" has its old value, and a public-school boy with the usual public-school attainments may score success. But engineering is just as impossible to such a youth as medicine, or surgery, or the law would be; though, unfortunately, the profession is not yet protected like medicine, or surgery, or the law, against the unfit. Yet where an incompetent doctor may kill one sick man, an incompetent engineer may drop a lift-full, or smash up a train-full of healthy people.

To the main question we would therefore answer that an indispensable part of the training of all engineers, except rare men of genius, is a thorough scientific course in a University.

To suggest improvement in the methods of training and a closer co-operation between University Research Departments and trade, and a better appreciation (from a salary point of view) of the finished product, follows naturally; but on these points we await with interest the result of the questionnaire.

Electricity in Agriculture.

The resumed discussion on Mr. R. Borlase Matthews's paper at the I.E.E. last week assumed a complexion totally differing from that of the first occasion. There was an atmosphere of optimism, progress, and development in which the prospects of farming with the aid of electricity assumed a roseate hue, and the enthusiasm with which the case for electricity was presented was heartening. Stress was laid on the remarkable progress which electrical methods had made on the Continent, especially in South Germany, where, Dr. Crowley said, almost every farm was using electricity, and Mr. Carney pointed out that so far from electrical applications being confined to large farms, it was the small-holder who derived the greatest benefit from them, he being unable to employ much labour. The extended adoption of electricity on dairy farms in Denmark and in New Zealand has already been recorded in our pages, and in a recent article by Mr. Lawrence Birks, chief electrical engineer to the N.Z. Public Works Department, it is stated that the demand for this purpose will constitute a large proportion of the total demand for hydro-electric power in the Dominion.

Mr. E. K. Scott struck a novel note when he advocated the manufacture of fertiliser by the farmer himself with the arc process, which, he declared, was easy to carry on, even on a small scale, and could be started and stopped at any time, to suit the user's convenience. This proposition may be somewhat beyond the capabilities of the small farmer, but its possibilities in the hands of a co-operative body should not be overlooked, and the supply authorities especially ought to bear it in mind as a useful off-peak load.

Perhaps the most striking and impressive statements were those made by the author in the course of his reply—that since the war more than half the motors made by Continental manufacturers were destined for farm work, and that electricity at 2s. a kilowatt-hour would be cheaper than horses. Accepting these figures in view of Mr. Matthews's unquestionable knowledge of the subject, it is clear that we have in our rural areas a magnificent electrical market which is as yet practically untouched, and the electrical industry is greatly indebted to the author for drawing attention to it so effectively.

D

FOREIGN TRADE REVIVAL.

By ERNEST T. WILLIAMS.

It will probably be unnecessary in this article to dwell on the great importance to this country of foreign trade revival. It is significant that on November 26th last two members of the Cabinet made statements on this subject. Lord Birkenhead, the Lord Chancellor, speaking at Tunbridge Wells, said:—

"We must address ourselves to the restoration of the markets of the world as a whole, without inquiring whether they were enemy or friendly markets. All we needed to ask was whether they were markets that would co-operate with us in recreating and restoring the prosperity of the world."

Mr. Stanley Baldwin, President of the Board of Trade, said:—

"If the loss of working days is at the same rate as last year it means death."

It appears to be a peculiar characteristic of the British people that they fail to foresee and provide beforehand to meet a crisis, but rather wait till it comes upon them, and then "muddle through." This has been repeated over and over again in our history, and one need not therefore be greatly surprised that though, during the war, various authoritative statements were made as to the inevitable aftermath, no concerted steps appear to have been taken to provide for the present contingency.

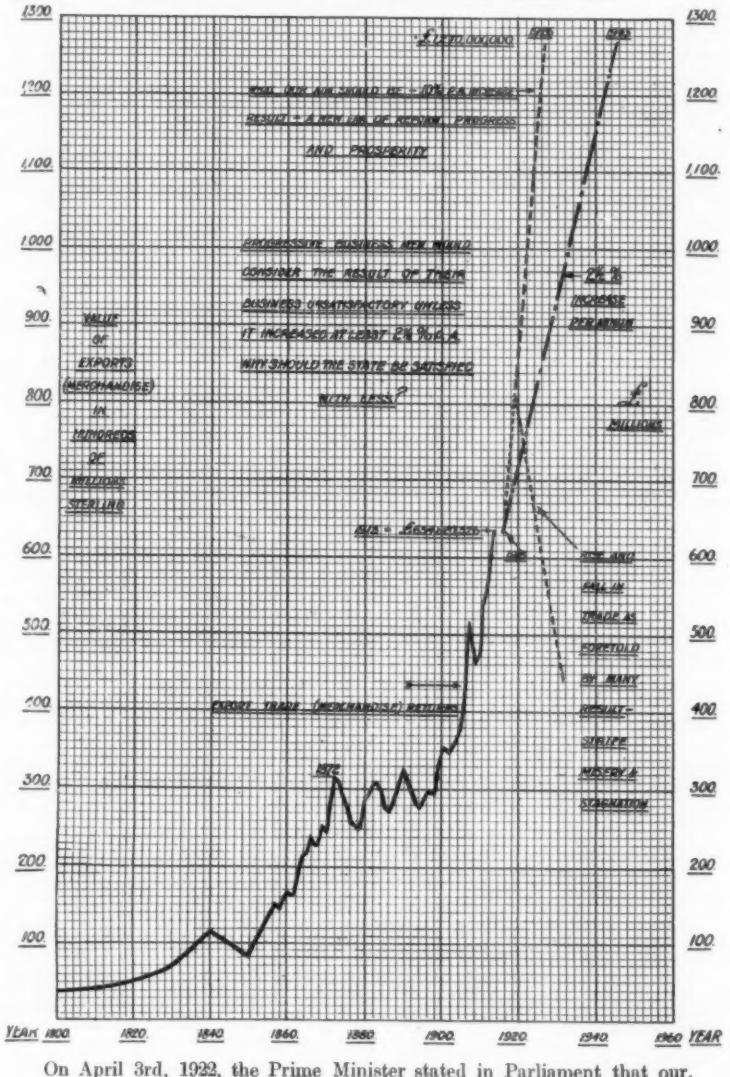
It is true that during the war a Ministry of Reconstruction was formed, but it appears to have had little effect, so far as foreign trade is concerned.

In a booklet published early in 1917, entitled "**Reconstruction and Foreign Trade**,"* the writer indicated in diagram No. I the boom to be anticipated in trade immediately following the armistice, also the present slump, and urged the necessity of organising to counteract it. In fact, constructive proposals were put forward for building up our foreign trade, so that the record rise prior to 1913 might be continued. Though these proposals created considerable interest, the concentration on war effort precluded their serious consideration. It is not without interest to note, however, that they were translated by a member of the Japanese Cabinet, who afterwards applied for the publication rights in Japanese.

At the invitation of the Editors of the Electrical Review, the writer proposes in this short article briefly to consider the proposals then put forward, though obviously it will not be possible in the space available to reproduce more than two or three of the diagrams or to enter into detailed explanations.

—DIAGRAM No. I.—THE FEDERATION OF COMMERCE.—

Showing the development of Exports (Merchandise) since 1800 A.D.



On April 3rd, 1922, the Prime Minister stated in Parliament that our foreign trade had now fallen to 50 per cent. below pre-war level.

It is only comparatively recently that the importance of foreign trade to this country has been realised by the general public. The home trader, for example, failed to appreciate the reflex action of good or bad foreign trade on home trade, and the workman has not altogether understood the dependence of this country on foreign markets for its material prosperity. It is now realised, even in labour circles, that greater individual prosperity can only be brought about by increased production, which, however, but serves to emphasise the fact that increased production is useless unless there is a sale for the resulting products.

Now in this country, which is unable to feed and sustain its population except through the importation of foodstuffs from abroad, the question of foreign trade is more vital than in a country which can be self-sustaining. In fact, our prosperity can roughly be measured by the rise or fall of foreign trade. It therefore follows that the keystone of industrial prosperity, good employment, mass production, contentment, higher standards of living, better education, &c., is foreign trade, and this being so, it is somewhat surprising that no concerted action has been taken by the people and government of this country to deal with this vastly important problem, for not only would this be desirable in ordinary times, but the present burdens of taxation, unemployment and unrest, call for exceptional measures.

Even though the flower of our manhood was diverted from productive operations during the war, our productive capacity reached a height never previously thought to be possible, which proves that, given a suitable outlet for production, not only would the unem-

* Published by Sir Isaac Pitman & Sons, Ltd., price 2s.

ployment problem cease, but also the prosperity and standard of living of the individual would be greatly increased. The statement that we can "produce the goods," therefore, requires no confirmation.

How, then, is it possible to revive our foreign trade, and ensure that permanent and steady increase, which should follow the introduction of more scientific methods of production and the normal increase of population? It has been the writer's privilege to fill positions in private trade, and Government and municipal departments, and without entering into a discussion of the various reasons, it is his confirmed opinion that trade, and particularly foreign trade, is best left in the hands of private enterprise. In considering the following proposals, it is important that this should be kept in view, as any organisation should, in the writer's opinion, have for its final and sole purpose the encouragement and assistance of private enterprise in foreign trade.

that the hub should be the work of trade itself and under its control, though it would be desirable to insure that full measure of support which the Government, with its various world-wide ramifications can give, by having a *limited* representation of the Government as part of the scheme.

Prior to the organisation of the Federation of British Industries, the writer had suggested that this hub should be called the Federation of British Commerce, and that it should be controlled by a *Central Board, Council and Committees* in London, the Board to be made up of the following twelve members:—

Engineering,	Miscellaneous trades,
Textiles,	Finance,
Transport,	Law,
Agriculture & Fisheries,	Government departments,
Mining,	British Dominions,
Chemical,	Parliamentary,

PRESIDENT.

Engineering Member.	Textiles Member.	Transport Member	Agriculture and Fisheries Member.	Mining Member.	Chemical Member.	Miscellaneous Trades Member.	Financial Member.	Legal Member.	Government Depts.' Member.	British Dominions Member.	Parliamentary Member
With separate Heads of Departments for:—	With separate Heads of Departments for:—	With separate Heads of Departments for:—	Projects for Inter-Empire Trade.	With separate Heads of Departments for:—	Coal Tar Products.	With separate heads for a limited number of Departments as found necessary (say three).	Currency and Exchange Problems.	International Law and Treaties.	With separate Assistants for dealing with:—	With separate Heads of Departments for:—	Representing the Federation in Parliament.
1. Civil Engineering 2. Mechanical ,, 3. Electrical ,, 4. Miscellaneous Engineering Trades.	1. Cottons. 2. Woollens. 3. Miscellaneous Trades.	1. Shipping. 2. Railways. 3. Miscellaneous Trades. (including aronautics).	International Laws affecting Fisheries.	1. Coal and Oil. 2. Metals. 3. Miscellaneous Trades.	Medical.	Advertising Schemes.	Loans to Traders.	Treaties affecting Commerce.	1. The Treasury. 2. The Foreign Office and Consular Service. 3. The Board of Trade. 4. The Colonial Office. 5. The India Office.	1. Canada. 2. Australia. 3. New Zealand. 4. South Africa. 5. Crown Colonies. 6. India.	Answering Questions in Parliament.
All Engineering Subjects, Schemes, Developments, Projects, &c.	All Questions affecting the development of Trade in Textiles.	Canals.	Investigation of Imports beneficial to Agriculture.	The Development of the Empire's Resources in Oil, Fuels and Metals.	Dyes.	Insurance.	Government Loans to Trade Banks.	Legal Advisor to the Federation.	Government Grants to the Federation.	The Heads of Departments would be appointed by the Dominions they represent, and would specialise in the encouragement of inter-empire trade in all its Branches working with the Technical Departments of the Federation for this purpose.	Attending Parliamentary Committees and Inquiries affecting Foreign Commerce
The Import of Raw Materials for the Engineering Trades.	The Import of Raw Materials for Textile Trades.	Co-operative Transport.	The Cultivation within the Empire of Raw Materials, &c., to make the Empire entirely self-containing.	Foreign Mining Laws.	Fertilisers.	Foreign Exhibitions.	Reporting on Loans to Foreign Governments.	Foreign Laws affecting Commerce.	Assistance of the Federation by Government Departments.		Representing Parliament on the Board
Inventions and Discoveries.	Inventions and Discoveries.	Foreign Railway Projects from the Transport Standpoint.	The development of any Food Imports into the British Isles from the Dominions and Dependencies.	The Import of Metals and all Mined Products.	Analytical Work.	Foreign Exhibits at British Exhibitions.	International Finance.	Forms of Agreement for use in Foreign Trade.	Inter-communication between the Government and the Departments of the Federation.		The Parliamentary Member would be a Member of the House of Commons and his Deputy a Member of the House of Lords.
		Advice to Traders as to best and cheapest facilities.		The Export of Coal and all Mined Products.	Reporting on all descriptions of substitutes.	Educational Problems affecting Commerce.	Reliability of Foreign Securities.		Government Loans for the Encouragement of Trade.		
		Shipping Documents.			Reporting on all new chemical discoveries which may be beneficial to Manufacture or to British Commerce.	Foreign Traders or Deputations visiting England.	Import and Export Tariffs in Foreign Countries.				
		International Laws affecting Transport.				British Trade Deputations visiting places abroad.	Foreign Methods of Financing Trade.				

Diagram No. II, showing the Governing Board of the Federation of Commerce.

The position to-day has been likened to a wheel, the rim of which is private enterprise, the spokes being the diplomatic service, Consular services, the Overseas Trade Department, chambers of commerce, the federated British industries, the numerous trade associations, and other organisations which have for their object the assistance of private enterprise. It is a remarkable fact, however, that no *hub* exists into which these spokes are joined, and therefore the trade wheel cannot be said to have been completed, or to be in a position to revolve efficiently for foreign trade expansion. It would appear to be obvious that the first step towards reform should be the building up of this hub, and the satisfactory connecting to it of the spokes.

A critic might state at this juncture that "we are sick of committees and organisations," but that would be begging the point. A wheelwright might be tired of his job after constructing the rim and spokes of a wheel, but it would be folly for him to fail to complete the hub, without which the wheel itself cannot be complete, and the writer would earnestly maintain that it is just as foolish to fail to complete the foreign trade hub, for without it many of the enormous possibilities of the rim and the spokes are rendered latent, whilst with such a hub they would be far more valuable and important to private enterprise than at present.

For many years it has been thought that this hub should be provided by a Ministry of Commerce, but the writer feels that there is a better way than introducing a new Government department. He would rather suggest and the foregoing diagram indicates the main items of work under the various members. It is interesting to note that the first item under the financial member is "Currency and Exchange Problems," though at the date when the diagram was produced very little was heard of such problems.

The heads of these departments would be members of the Board and elected every five years by the trades they represent. In a few instances there would be separate departments under each member with separate departmental heads, who themselves would be elected quinquennially by the trades they represent. Each member of the Board would have an elected advisory committee, and where there are departmental heads they would also have elected advisory sub-committees. The Board, committees, and sub-committees would be efficiently co-ordinated. The Council would comprise the members of the Board, heads of departments, advisory committees, and a limited number from the advisory sub-committees.

Space will not allow a detailed statement to be made of the work of this hub, but a little reflection will show that as it would represent the united interests and trade organisations of the country, it could speak with a voice of great authority, and render private enterprise, both directly and through the various trade organisations, such service as would inevitably lead to a considerable impetus in trade revival. For example, there is little doubt that the enormous resources and facilities of the Imperial and Dominion Governments would be willingly and readily placed at the disposal of such an organisa-

tion, in which the Governments themselves would be represented.

The writer considers that the above is the first step to be taken, but it is desirable to indicate what further expansion could and probably would readily follow the establishment of such an organisation.

In all large world centres there are leading diplomatic, Consular and trade representatives, and, referring again to the analogy of a wheel without a hub, there is the same lack of co-ordination of British interests, as at home. It would therefore be desirable to provide similar *Divisional Boards* in these centres, though on a much smaller scale than the Central Board. These Divisional Boards would deal with local problems, but would be under the direction of the Central Board in London. The following diagram indicates the centres in which it is proposed such Boards should be established:—

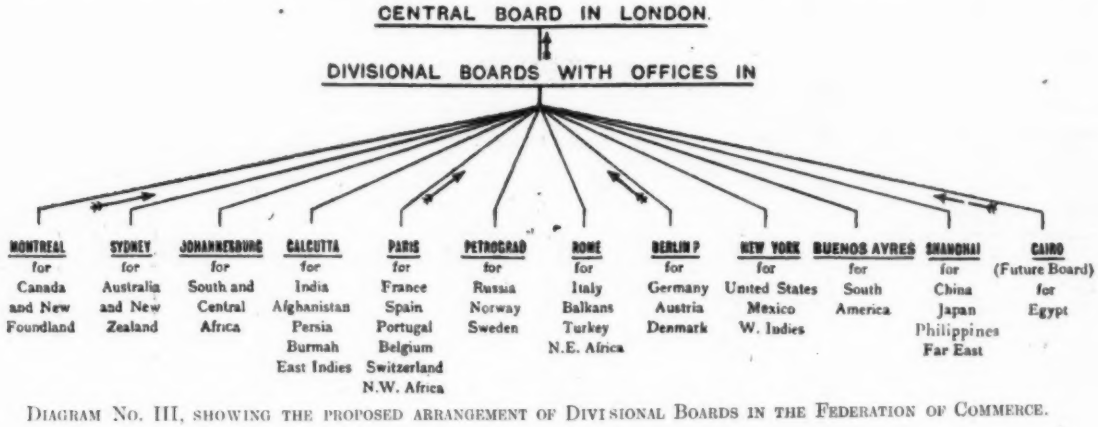

CENTRAL BOARD IN LONDON.
DIVISIONAL BOARDS WITH OFFICES IN
MONTREAL for Canada and New Foundland
SYDNEY for Australia and New Zealand
JOHANNESBURG for South and Central Africa
CALCUTTA for India Afghanistan Persia Burmah East Indies
PARIS for France Spain Portugal Belgium Switzerland N.W. Africa
PETROGRAD for Russia Norway Sweden
ROME for Italy Balkans Turkey N.E. Africa
BERLIN? for Germany Austria Denmark
NEW YORK for United States Mexico W. Indies
BUENOS AYRES for South America
SHANGHAI for China Japan Philippines Far East
CAIRO (Future Board) for Egypt

Diagram No. III, showing the proposed arrangement of Divisional Boards in the Federation of Commerce.

It is thought that the divisional boards should have heads for the following departments:—

Engineering,
Textiles,
Agriculture and Mining,
Miscellaneous (including Transport, Chemical),
Finance and Law,
Diplomatic and Consular Services,
Dominions;

and there is little doubt that small local British Advisory Committees could be formed for each of the departments named.

It will be seen that the formation of such divisional boards would result in stiffening up, or strengthening, the position of the local British representatives, which would be all to the good of British trade. In addition, it will be clear that the advantage to the central board in London of being able to obtain direct expert opinion on the spot, concerning the many complex problems that would have to be dealt with, would be an asset of great value. The formation of divisional boards should, therefore, be the second step in the reorganisation necessary to secure foreign trade revival.

A superficial study of a map of the world will at once show what vast areas would be covered by these divisional boards, and it would no doubt follow in due course that they would decide to establish *District Commissioners* in the more important centres. Such district commissioners would require small local staffs of natives, who should, however, be specially trained to deal with the various branches of industry.

As a result of the appointment of such district commissioners, it would no doubt be desirable later to appoint *Native Agents* to work under them. It would be the duty of such agents to hunt round for trade openings and to assist the representatives of British firms in their districts to obtain orders, for after all, the crux of the whole problem of foreign trade is the assistance of private enterprise *on the spot* in order that new trade can be created, new concessions obtained, and various openings developed.

It is interesting to note that in "Reflections of a Financier," recently written by Mr. Otto Kahn—one of America's leading financiers—who threw all his resources and energies into the cause of the Allies, the question of economic organisation is dealt with. In one of his essays he discourses on "The need for a general economic staff," and points out that America—and for that matter other countries—failed to take full advantage of the "unprecedented opportunities within their grasp after the Armistice." He says:—

"We should have had (as some of us urged during the war) in one of the departments of the Government a competent economic general staff, with well matured plans prepared and ready for the occasions as they arose. Some of the opportunities then before us are no longer recoverable, but many others remain. . . . If, however, business pulls one way, labour another, farmers a third, and Government or politics a fourth, the result is much waste motion and lost effort, and a serious impairment of our national effectiveness."

It will be seen that the writer of the present article advocated, and still advocates, a somewhat similar line of policy, with the following two important differences, *i.e.* (*a*) that this Council should deal with foreign trade only, a sufficiently important subject in itself, and (*b*) that this Council should *not* be a branch of a Government department, but set up and controlled by Trade itself, with merely Government department representation.

The question will naturally be raised as to how such an organisation as that proposed could be financed, and in this respect it is very important to bear in mind that the cost as compared with our foreign trade would be very small indeed, and that the benefits to be derived should be out of all proportion to the cost. It has been suggested that a very small *ad valorem* percentage might be voluntarily paid by exporters who participate in the scheme, so that their contribution would bear some direct proportion to their actual exports. In the initial stages it is probable that 1s. per £100 (one twentieth of 1 per cent.) would cover the charges. In view of the heavy demands on the Exchequer for unemployment doles and relief work, it is anticipated that there would not be great difficulty in getting some Government backing, as the direct saving to the Exchequer of a scheme of this kind would be enormous if it tended to help the revival and extension of trade. Similarly it is thought that banks and financial houses would be willing to make a contribution. The scheme could probably be started by the Government undertaking to make good any deficiency in the annual balance sheet up to but not exceeding £250,000 per annum. It is hoped that once the scheme got well started there would be no deficit and no call on the Government guarantee. If exporters who were members of the organisation did export trade to the value of £500,000,000 per annum, 1s. per £100 would represent an annual income of £250,000. A simple way of collecting this revenue would be to issue (under authority) stamps suitably endorsed with the

name of the organisation, which could be affixed to bills of lading.

Without entering into this further, it will be seen that a very simple means could be devised of collecting the revenue. Firms and associations joining the organisation would, for this small contribution, be able to call upon the organisation's influential resources throughout the world, but at the same time would be entirely free from any kind of control.

Space does not permit of the consideration in detail of these facilities, which, however, would be very considerable. Apart from this direct benefit, however, there would be the indirect advantage of the influence the organisation would have on trade as a whole, speaking as a co-ordinated inter-Empire and representative authority on trade questions.

It is vital to the well-being of the Empire that we should greatly increase our Inter-Empire trade, and an essential part of the scheme is the full participation of our Dominions in it. It has been shown in the booklet upon this subject how this could readily be arranged by enabling any Dominion to be represented at its own cost on the Central Board, Divisional Boards, and District Commissioners' Staffs. Unless some such scheme as this is carried out at an early date, the Dominions will make their own arrangements for trade representatives, and the possibility of having a joint Empire organisation will for ever be lost.

Many leading business men who have studied the scheme have been impressed with its great possibilities, but there appears to be a tendency to leave any steps of this kind to the Government. On the other hand, the attitude of the Government has been to leave the initiation of such schemes to private enterprise. It is exceedingly unfortunate that this "leaving it to the other fellow" attitude is persisted in, as it is now evident that it will take the united efforts of all concerned to bring about economic stabilisation, and restore British trade to its rightful place. If one or more powerful trade groups took the initiative, there is little doubt they would meet with quick response from the Government, which is at its "wits' end" to know how to deal with trade revival and the unemployment problem. To mention but one of the very urgent matters in which the organisation could play a leading part, we need only refer to the question of currency and exchange. The financial member of the board and his advisory committee, representing the financial interests of the Empire, could, in co-operation with the various trades represented, put forward with no uncertain voice a demand for international action, and incidentally, the organisation could give valuable expert advice to its members on the various exchange and currency problems in any part of the world to which they may be exporting.

The writer believes that the setting up of a Royal Commission to report on the subject of foreign trade revival—or any other similar temporary expedient—would be quite inadequate.

Similarly the occasional calling in of a few business men to give advice to the Cabinet only touches the fringe of the subject. What we need is a Trade Council—or Parliament—under the control of trade itself, with a permanent, live board of experts, any one of whom can be changed quinquennially if the trade he represents desires to make such a change. These gentlemen should be the best experts obtainable in each trade, and though the salary (say £3,000 per annum) may be considerably lower than such men's market value, yet their public spirit, together with the honour of being elected to and of holding such a position, would no doubt help to attract the right men. A point of very great importance is that they would be able to devote the whole of their time, energy, and thought to their own particular branch of trade, and in this work they would be assisted by their expert advisory committees. Foreign trade should be dealt with as a non-political subject, and the best brains of the country should be secured to devote their attention to the carrying out of a progressive programme and continuous policy.

Fluctuations in trade should, as far as possible, be foreseen and provided for. If, for example, such a board had been set up after the Armistice, it is certain that it would have realised the temporary nature of the boom and have forecasted at an early date the inevitable slump, and would, with an authoritative voice, have issued a warning which would have saved business firms many millions sterling and have prevented the sudden collapse which has so undermined that *confidence* which is essential to good trade, that it is likely to be a long time before it is fully restored again.

The board should be the expert medium for advising and assisting in foreign trade matters generally, whether this concerns the development of new resources for obtaining raw material—cotton for example—the importation of raw material from the best and cheapest world sources, or the export of our manufactured or other products. The board would be of great value in advising the Government on all matters of trade and commerce.

In conclusion, there is a feeling abroad that we have only to "sit tight" and things will come right of themselves, and there may be something in this if we are prepared to wait a number of years, but in the meantime what is to be done to alleviate the misery and wretchedness and the danger of national strife ever lurking in the shades of bad trade? The sooner we address ourselves seriously to taking concerted action on this important problem the sooner shall we regain something of the prosperity of pre-war years. Nay, even more—the possibilities opened up by adopting efficient methods of foreign trade expansion are sufficiently great to make us believe that the future holds very much more of prosperity than the past if we but take steps to realise it, and the writer submits that it is the duty of our traders to address themselves to this problem, and use every effort to obtain such united action as alone can bring about the desired result.

The U.S. Federal Power Commission.—The first annual report of the Federal Power Commission discloses the fact that prior to 1920 there was comparatively little water-power development. The flood of applications which has followed the passage of the Federal Water Power Act of 1920 and the projects on which, notwithstanding the industrial depression and the uncertain financial situation, construction has already started under licence issued by the Commission, is abundant proof, both of the extent to which former legislation stood in the way of power development and of the generally satisfactory character of the present law.

In the 16 months following the passage of the Act there were filed with the Commission 185 applications for preliminary permit and 85 applications for licence to develop water power, 260 in all, which, after deducting conflicting applications and those rejected or withdrawn, aggregated the stupendous totals of 11,060,000 primary and 5,766,000 secondary h.p., or 16,826,000 h.p. of estimated installation. This is twice the water power which has been developed in the United States to date, and exceeds the combined potential water-power resources of Norway, Sweden, Finland and the Arctic and Baltic drainages of Russia. It is 70 per cent. greater than the combined resources of France and Italy. It is from five to six times greater than the aggregate of all applications filed with the Federal Government during the preceding 15 years.

The country could not, of course, absorb at once all the power projected for development, and many applications may never be carried out. It is believed, however, that the greater part of the works involved will eventually be constructed. To complete the projects applied for will require capital exceeding in the aggregate two billions of dollars. The collateral expenditures for distribution systems, for customers' installation and in accessory industries will be several times greater. Much time and care has been devoted during the year to compilation of the rules and regulations governing administration of the Federal Water Power Act. The first ten regulations included matters which had been covered in considerable degree by regulations under earlier laws; the remaining subjects to be covered were largely new. —*Journal, A.I.E.E.*

TEMPERATURE STRESSES UNDER SHORT-CIRCUIT CURRENTS.

By H. S. HOLBROOK, B.Sc., A.M.I.E.E., Assoc.A.I.E.E.

General.

The short-circuit currents which occur on modern electrical systems are so large that small section conductors in the path of the current reach a very high temperature in a short space of time. There are usually such conductors in the primary windings of small ampere-rating, multi-turn primary current transformers. It is, therefore, necessary when installing current transformers on large systems to consider the possible short-circuit current through the circuit and to state a limit to the minimum primary rating of current transformer which can be employed.

On the usual short-circuit conditions the time is so short that there is no appreciable dissipation of heat during the period of the short circuit. All the heat generated is absorbed in the apparatus in raising its temperature; for example, there is a case on record where the current through a rubber-insulated cable forming a potential transformer connection was so great that the copper was volatilised, bursting the cable, and yet the rubber insulation showed no signs of heating, but still wore the impress of the strands of wire.

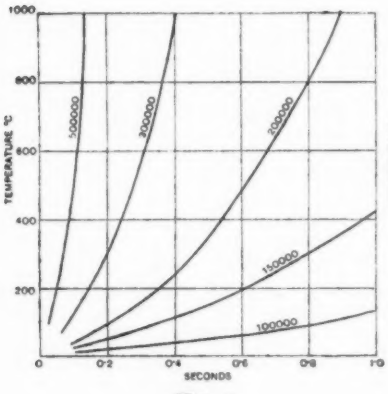


Fig. 1.

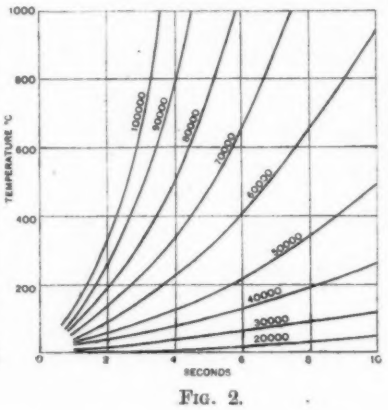


Fig. 2.

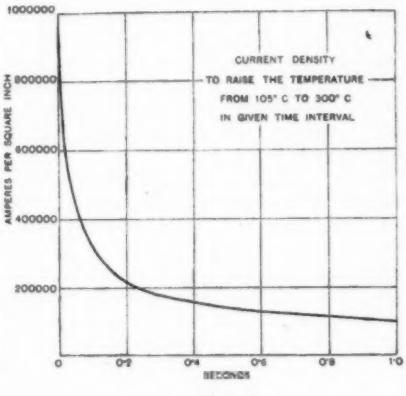


Fig. 3.

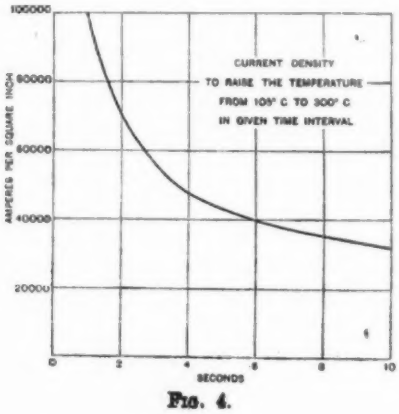


Fig. 4.

It is convenient to consider this subject in four sections:—

(1) Temperature rise with direct current or alternating current of constant r.m.s. value.
(2) Limiting temperatures and current densities.
(3) Short-circuit currents in practice.
(4) Recommendations for minimum size of current transformers.

(1) Temperature Rise with Constant Current.

In estimating the temperature rise, allowance must be made for the increased heating due to the increased resistance of the apparatus as its temperature rises. If we do this and assume the usual figures for the physical properties of copper, we deduce the curves given in figs. 1 and 2, which show how the temperature rises with the time for various current densities. It will be noted that for higher densities the rise is almost instantaneous, which shows the undesirability of extra heavy overloads for even a short time.

(2) Limiting Temperatures and Current Densities.

To utilise the curves in fig. 1 and fig. 2, it is necessary to consider limits for the initial and final temperatures of the apparatus during the short-circuit period.

The initial temperature will be that attained by the windings under normal load, and in the curves given later it has been assumed that this limit of working temperature is 105 deg. C.

The maximum temperature which we may permit depends on how often and for how long the apparatus will be exposed to short circuits, and on the temperature characteristics of the insulation. Obviously the windings must not be permitted to reach even momentarily a temperature at which gas is explosively evolved. It has been experimentally determined that this occurs at about 350 deg. C. for the class of materials in general use. A limit of 300 deg. C. is therefore suggested for the highest temperature which may be attained during the short-circuit period.

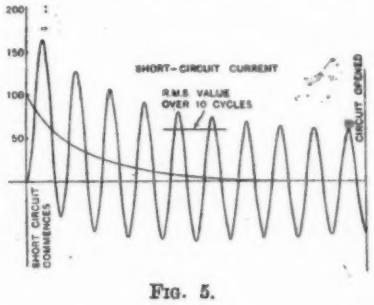


Fig. 5.

Using these figures for the limits, namely, 105 deg. C. and 300 deg. C., we can deduce from figs. 1 and 2 the permissible current density for short circuits lasting a given time. In this manner we obtain figs. 3 and 4.

(3) Short-circuit Currents in Practice.

If a circuit is fitted with definite time-lag relays, it is desirable that the possible short-circuit current in any circuit be calculated. If, however, the oil switch has no delaying device, the following may be noted.

In practice the current during a short circuit in a big power station is not generally constant. If the short circuit occurs when the voltage wave is passing through its zero value, the short-circuit current will experience a "doubling" effect, and there will be a transient depending on the ratio of the circuit reactance to the circuit resistance. Also, the line voltage will generally drop, due to armature reactance, &c. Fig. 5 shows how the current varies in a typical case. This diagram is not plotted for more than 10 cycles, corresponding to 0.2 second on a 50-cycle system, as the B.E.S.A. recommends the assumption of that time interval as the time required to open a modern "instantaneous" oil switch.

In the majority of stations it is, however, standard practice for the switchboard attendant to close any circuit breaker which trips automatically, and if this is done before the short circuit has cleared itself there will be in consequence a second rush of current. It is nearly correct to assume that the temperature produced by two such rushes of current is the same as would be produced by constant current of the r.m.s. value of the current in fig. 5 taken over the whole short-circuit period.

The r.m.s. value for the whole short-circuit period with the current varying as shown in fig. 5, is eight-and-a-half times the full-load r.m.s. current, if the current is supplied by a generator having 10 per cent. effective impedance under short-circuit conditions and assuming that the current is limited only by the generator impedance.

(4) Minimum Size of Current Transformers.

From fig. 3 the limiting density for a current of constant r.m.s. value producing a limiting temperature of 300 deg. C. at the end of 0.4 second is 160,000 amps. per square inch.

It is common practice to run the primary windings of current transformers at a current density when carrying rated primary current of 1,500 amps. per square inch.

If we consider a case when all the generators are available for feeding a short-circuit current passing through one current transformer, and assume the fault has no resistance and that there is only the generator reactance to limit the short-circuit current, then it follows from the above notes that the primary current rating for that current transformer must not be less than the combined full-load rating of all the generators divided by (160,000)/(8.5 × 1,500), *i.e.*, the rating of the current transformers must not be less than 1/(12.5) times the combined full-load current rating of all the generating plant.

Of course, in practice the fault has usually appreciable resistance, and smaller current transformers than given by this rule have been used with satisfaction. Again, the use of feeder reactors and bus sectionalising reactors helps to reduce the severity of the short-circuit currents. It is preferable, therefore, in all cases, and especially when the circuit breakers have time lags fitted, to calculate the short-circuit current for the particular case and estimate the minimum permissible rating of the current transformer with the aid of figs. 3 and 4.

ELECTRICAL DEVELOPMENTS IN SOUTH AMERICA.

[From Our Special Correspondent.]

The electrical power plant of the Argentine State Railways at Tafi Viéjo, in the Province of Tucumán, is about to be further extended. The plant, which has a capacity of about 2,000 h.p. in six vertical, triple-expansion engines, direct-connected to 240-kW, 220-volt direct-current generators, is considered one of the most complete in Argentina, having been in operation since 1911. So far, the largest hydro-electric plant erected in the district is that owned by the Compañia Hidro Electrica de Tucumán, on the Lules River, now in the tenth year of its operation. Argentina presents a favourable field for the introduction of small electric plants, in addition to electrical supplies, such as lubricating oil, belting, lamps and accessories.

Electrically-operated machinery has been adopted in connection with a new blast furnace erected in Jujuy, the first of its kind in Argentina. Large beds of lead and iron ore in the vicinity are being treated, the enterprise employing between 90 and 100 men, and producing about 24 tons per diem. So far success has attended the enterprise, and it is thought that a wider employment of electrical machinery in similar industrial enterprises will result.

Electrical machinery is becoming more in use upon Argentine sugar-plantations, especially in the districts of Tucumán and Mendoza. At the end of last year three large plants had been erected in Tucumán, and four others owned by the Compañia Anglo-Argentina, in the same district. Electrically-operated shops have been erected by the Central Argentine Railway, at Perez, near Rosario, while the port-works in the same city have now completed their plant, developing 1,000 kW, manufactured by Messrs. Schneider et Compagnie, at Creusot, France. The internal combustion engines in use show a variety of makes, including British, French, Italian, American, and German.

The Province of Santa Fé, Argentina, which possesses a number of important waterfalls that could be utilised for the development of electric power, is considering a wide extension of hydro-electric power plants. Several concessions have been applied for, the majority of which will doubtless be granted. At the Bamba plant, Cordoba, the head is about 95 ft., and at the Calera plant, located in the same district, the fall is about 145 ft., while at the Rio Priméro the turbines operate with a head of about 35 ft.

A new electrically-operated omnibus line has been authorised for the city of Buenos Aires, destined to improve passenger transport facilities between the various railway stations and outlying suburban districts. Four lines in all will be established, uniting the following points: Once de Setiembre and Constitución railway termini, belonging to the Buenos Aires Western and the Buenos Aires Great Southern railways respectively; Once de Setiembre and Retiro, the terminus of the Buenos Aires Central Railway; Retiro and Constitución; and Plaza Congréso and Plaza Itália.

The Argentine market for electrical goods, hitherto largely dominated by Germans, presents at present a field of great competition upon the part of British, Italian, Dutch, and other European manufacturers, in addition to a strong bid for supremacy upon the part of United States firms. Two of the largest German manufacturers are maintaining local branches, and carry large stocks of electrical apparatus, besides maintaining travelling salesmen to all parts of the Republic and technical staffs to assist in planning designs for central stations. Italian interests are centred in two large branches of home factories, the methods of selling adopted being much about the same as the German. Only one British manufacturer of electrical goods has arranged direct representation, and this through an affiliated company. A Dutch factory has proved a strong competitor in the lamp market since 1914, sales being conducted, through a representative, to large dealers only. A considerable amount of advertising is

carried on, and heavy stocks are maintained, most of them being on consignment to agents. The position of American manufacturers is also very strong, with direct factory branches of four of the larger United States firms and permanent resident representatives of three or four other leading companies. On the whole, European designs are preferred, and machinery is rated in accordance with European specifications as regards heating and overloads. The supply lines are mostly heating-appliances, incandescent lamps, insulators, insulated wire and lamp sockets; strong competition is met with in all these from local manufacturers.

The continued high price of imported coal in Brazil has rendered the employment of hydro-electric power more popular, several of the newest factories having arranged to introduce electrical motive power. Among these is a new sugar-mill inaugurated in the State of Rio de Janeiro, near the Tangua station of the Leopoldina Railway, the first sugar-mill to be introduced entirely operated by electrical power, although an auxiliary steam-plant has been provided in case of emergency. In Parahyba, what is regarded as the largest and most up-to-date tannery in South America has just been completed with a plant fitted with new electric tanning machinery. The work turned out is said to be on a par with that of the best tanneries in other parts of the world. A third factory to be equipped with electrical plant is the Fabrica do Fulminante Nacionál e Polvora Jacare, which is now manufacturing fulminate and powder of very high grade at Novo Iguassú. Electrical machinery to be introduced is expected to prove highly successful as well as economical.

Similarly-operated machinery is contemplated in connection with an oleo-margarine factory, the enterprise of a Dutch syndicate, and with a phosphorus factory located at Sao Jeronymo, the property of the Minas Railway Co., in the State of Rio Grande do Sul. The machinery has been ordered to special design in France.

The Mexican Government continues to offer inducements for the establishment of hydro-electric plants in or near the Federal district, supplementary to, and, consequently, in competition with, existing power plants, mainly owned by British corporations. A recent decree has been issued reducing Federal taxes on the use of water for power and irrigation, and, among other proposals under consideration, are two submitted by Mexicans for irrigation and hydro-electric plants.

Two electrical installations have recently been adopted by two industrial enterprises at Mazatlán (Mexico), the first in connection with a cigarette factory, acquired by an American firm; and the other in relation to a new brewery to be worked by electrical machinery, for the first time in this district. The daily capacity of the brewery is 90 barrels of beer, and eight tons of ice.

A concession for an electric railway has been granted to certain interests in Lima for a line from that city to the bathing resort of La Punta. The original concession was for a double-track road, but this has now been modified so as to permit of the construction of only 11 km. of single track from Lima to the village of Bella Vista, which must be put into use within eighteen months from the date of the contract. The prolongation to La Punta and the double tracking of the line must be completed within an additional two years.

THE ELECTRICITY WORKS OF GENNEVILLIERS.

Gennevilliers is a suburb to the north of Paris, situated on the left bank of the River Seine, and not far from St. Denis—about 10 km. (6¼ miles)) from Notre Dame. On this site a huge new power station has been erected, and is in course of equipment with plant which will have a rated output of 200,000 kW, and may be extended to 320,000 kW; it is therefore with some justice that the claim is made that this will be the most powerful generating station in the world. The first turbo-alternator, of 40,000 kW, was recently set in operation, and we think that some particulars of the installation may be of interest to our readers.

The work was undertaken by the Union d'Electricité, and was carried out under the direction of M. E. Mercier, deputy manager of the Union. A full account of the station is about to appear in *La Revue Industrielle*,* and a description of the civil engineering works appeared in the March issue of that journal over the signature of M. G. Mercier, Engineer-in-Chief of Bridges and Roads, who was in charge of this part of the undertaking. For the particulars that follow, we are indebted partly to our French contemporary, and partly to the Union d'Electricité, from which we also received the photographs here reproduced.

It should first be explained that during the war the various power stations supplying electricity to Paris were heavily overworked, and by the return of peace required extensive overhauling and renovation. On the other hand, some of the old stations generated three-phase, others two-phase current, at four different frequencies, and innumerable supply pressures were in use (how like London!). Hence it was decided to seize the unique opportunity for reorganising the distribution of electrical energy in the metropolitan area, and the Union d'Electricité was formed for this purpose in 1919. This project was only made possible by the fact that the various supply authorities realised that it was devised in their best interests.

The programme of the Union for the unification of electricity supply comprised the erection of a 200,000-kW three-phase power station, generating at 50 cycles, 6,000 volts, and the successive closing of the old power stations; the establishment of a vast underground network of transmission mains surrounding Paris and branching out towards neighbouring towns; and the erection of sub-stations in each of the existing supply areas to lower the pressure to the local supply voltage, the respective undertakers becoming solely distributing authorities.

Fig. 1.—Gennevilliers Electricity Works (January, 1922).

The finance of this great project, embracing an outlay of more than 250,000,000 francs, was based wholly upon

*An edition will be published in English; see our "Book Notices."

the enomomy that would be effected by the generation of electricity in one huge station of the most modern design, as compared with the cost of running the old power stations.

The scheme, so sympathetically received by those most directly concerned, was no less heartily welcomed by the public authorities; moreover, it harmonised with the general scheme of unification of electricity supply for the whole of France which was being developed by the Ministry of Public Works, and which will eventually enable the metropolitan area to be linked up with the hydro-electric power stations on the Rhone, the Rhine, and the "Massif Central," as well as the northern collieries.

The site of the Gennevilliers power station covers about 25 acres, and is provided with a wharf on the river, a railway siding, and a large coal storage area. The turbine-room is of steel construction with a reinforced-concrete foundation, and brick filling; its dimensions are 24.5 by 92.5 m., with a total height from the footings to the roof ridges of 42 m. It will contain five generating sets, of 40,000 kW each, with provision for extension to eight sets. Each set is mounted on a hollow platform of reinforced concrete carried by six columns of the same material, which rise from three heavy longitudinal walls running from end to end of the room. Beneath and between the turbo-alternators are situated the condensers, air-coolers, and auxiliary plant; and beneath these again are the lead and return ducts for the circulating water, the former being in duplicate. Two travelling cranes, respectively of 20 and 100 tons lifting capacity, serve the turbine-room. Alongside of the foundations of the generating sets are two galleries for cables and filtered air respectively, and next to these comes the transformer room, with a large battery room in the basement.

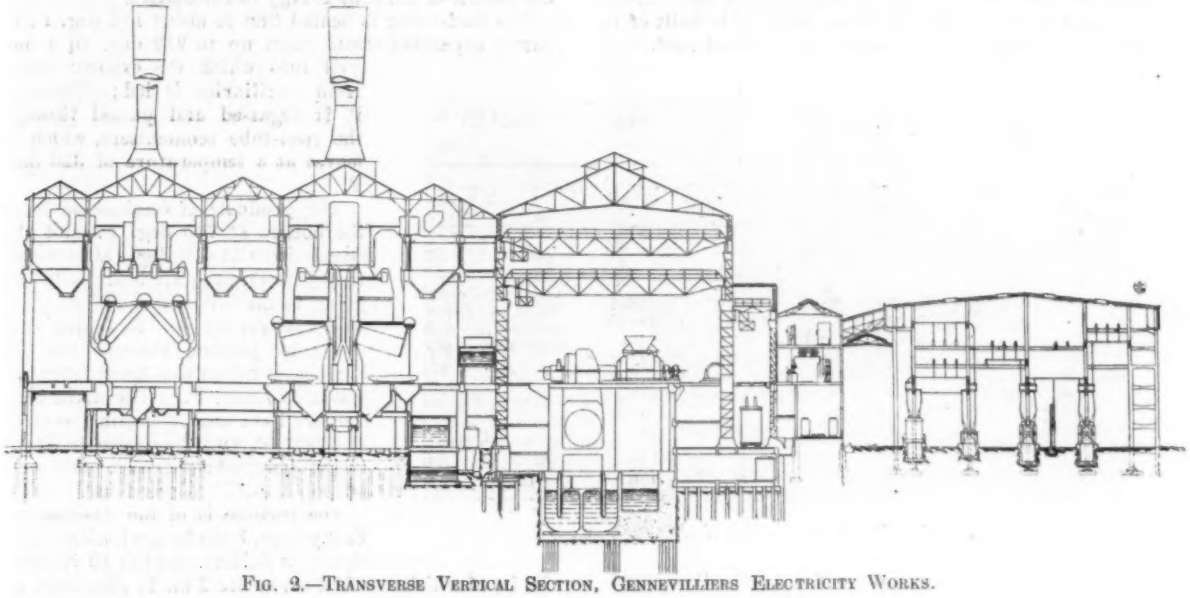


Fig. 2.—Transverse Vertical Section, Gennevilliers Electricity Works.

The transformer room is as long as the turbine room, and is of similar construction, 5 m. wide, with a 40-ton travelling crane. Beyond this room is the low-pressure (3,000-volt) switchgear room, 7 m. wide and 84¾ m. long, in three stories; besides the main switchgear it houses the auxiliary switchgear at 3,000 volts, the d.c. switchgear at 500 volts, and the three-phase switchgear at 220 volts, as well as the auxiliary transformers, the telephone exchange, the "dispatching" room, and the air filters.

The boiler-house is constructed of reinforced concrete

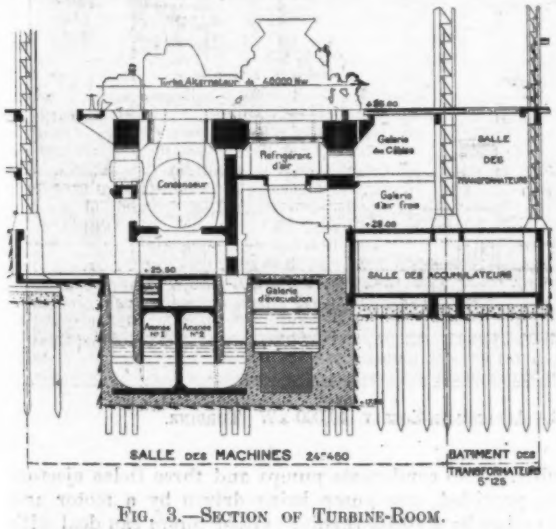


Fig. 3.—Section of Turbine-Room.

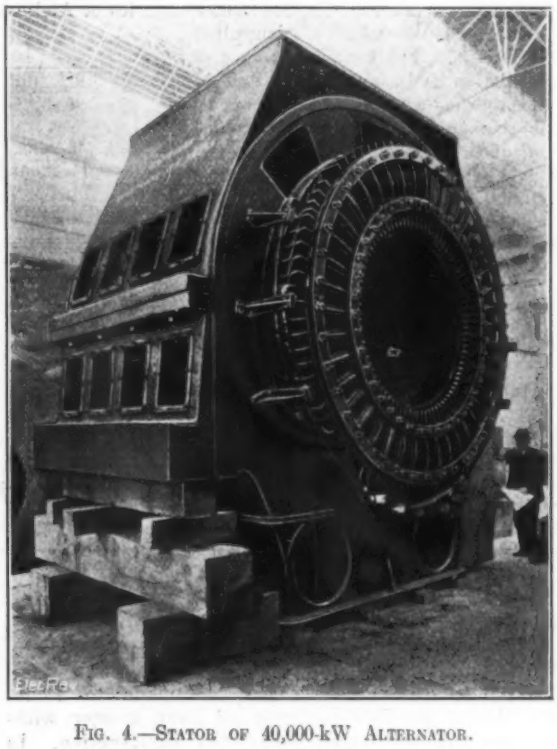


Fig. 4.—Stator of 40,000-kW Alternator.

with a steel-framed roof, and is 51 m. wide and 86 m. long. It contains two rows of boilers, one consisting of 10 Babcock boilers and the other of five of the Stirling type. In the basement are railways for the removal of ashes, &c., and above are coal bunkers having a total capacity of 3,800 tons.

The high-pressure switch-room (60,000 volts) is separated from the low-pressure switch-room by a covered way, and is 106 m. long by 29 m. wide; it is built of reinforced concrete columns with a low-pitched roof.

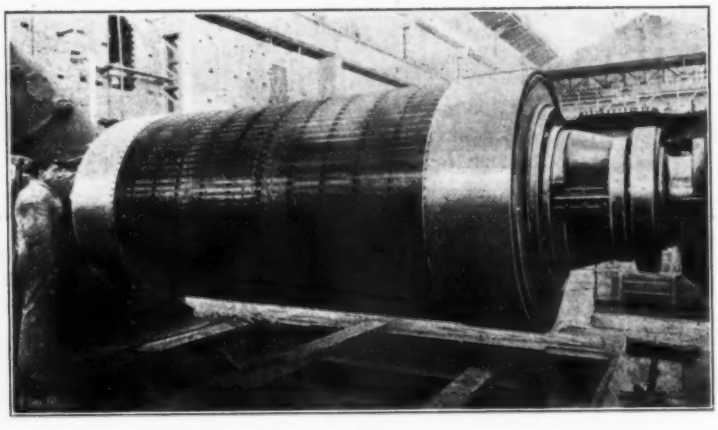


Fig. 5.—Rotor of 40,000-kW Alternator.

The Stirling boilers were supplied by the Compagnie Fives-Lille, and work at a pressure of 355 lb. per sq. in. They are fitted with Erith-Riley stokers, made by the Société Fama, and have each a heating surface of 22,600 sq. ft., with a guaranteed evaporation of 175,000 lb. of water per hour. The superheater has a heating surface of 10,764 sq. ft., the economiser 12,915 sq. ft., and the air heater 19,350 sq. ft. The Babcock boilers are equipped with stokers of the Babcock and Wilcox type, made by the S.A. des Fonderies et Ateliers de la Courneuve, which also supplied the boilers. The heating surface of each boiler is 14,000 sq. ft., that of the superheater 8,190 sq. ft., that of the economiser 17,235 sq. ft., and that of the air heater 24,120 sq. ft., the hourly evaporation being 116,000 lb.

The Prat system of forced and induced draught is used.

The turbines run at 1,500 r.p.m., with a steam pressure of 313 per sq. in., the temperature of the steam being 707 deg. F. Three complete sets are being supplied by the Société Alsacienne, one set and one alternator by Messrs. Schneider and Cie., and one turbine by Messrs. Escher Wyss & Cie., of Zurich.

We give herewith views of the component parts of these large sets. It is interesting to note that the alternators are cooled with air flowing in a closed circuit, with auxiliary cooling by filtered air. The first set is in operation, the second in course of erection, and the third due for delivery. In the design of the plant, every effort has been made to secure the highest possible economy of heat energy without too greatly complicating the construction. In particular, the dimensions of the turbine have been calculated to attain a very high thermodynamic efficiency, and special attention has been devoted to the recuperation of losses hitherto regarded as inevitable, including the bulk of the heat energy dissipated in the iron, copper, and ventilation of the alternator, as well as that due to friction in the bearings, and the condensate, withdrawn from the main condenser at the highest possible temperature, is reheated by bleeding the turbine in the low-pressure stages. The arrangements that have been made permit of the satisfactory cooling of the hot air from the alternator and the oil which has circulated through the bearings, and the return of the heat energy to the boilers.

The feed-water is heated first to about 176 deg. F. by partly expanded steam, then up to 212 deg. in a hot-well into which the exhaust steam from auxiliaries is led; afterwards it is degassed and passed through the steel-tube economisers, which it leaves at a temperature of 320 deg. F.

The products of combustion leave the boilers at 730 deg. F. and the economisers at 430 deg., after which they pass through air heaters, before going to the chimney at 300 degrees. The air supply to the boiler furnaces, by passing through the air heaters, is raised to a temperature of about 190 deg. F. The main condensers have each a cooling surface of 3,500 m², and the duplicate circulating pumps have each a maximum output of 6,750 m³ per hour.

The turbine is of the Alsacienne-Zoelly type, built by the Société Alsacienne at Belfort, and has 10 impulse wheels, of which the first seven are 2 m. in diameter, of Martin steel, and the three low-pressure wheels, of nickel steel, are 2.8 m. in diameter. The hollow shaft is of Martin steel, and the blades of nickel steel; the last of these are 573 mm. in length, and are galvanised and polished to avoid corrosion and reduce friction losses. The weight of the turbine rotor complete is about 18 tons. The cast-iron exhaust chamber weighs 70 tons.

The Delas condenser is 6.8 m. long and 3.8 m. in diameter; the shell is of riveted sheet, and contains 7,500 tubes. Two condensate pumps and three Delas ejectors are provided, one pump being driven by a motor and the other by a steam turbine; either pump can deal with the whole of the load.

Fig. 6.—Alsacienne-Zoelly 40,000-kW Turbine.

The reheating of the condensate with steam from the 7th and 8th stages of the turbine is effected in "auxiliary condensers," through which the condensate, partially heated by the air and oil coolers, circulates.

The cooler interposed in the closed circuit of air pass-

ing through the alternator is of the tubular type with a surface of 1,000 m², and is cooled by the condensate from the main condenser; when full of water, it weighs about 38 tons. Every precaution has been taken to provide for economical running at light load, or when the temperature of the circulating water or that of the condensate is unduly high.

As the result of all the efforts made to conserve heat energy, the makers have guaranteed that with steam at 313 lb. pressure and 707 deg. F., and circulating water at 59 deg. F., the heat consumption per kWh at a load of 30,000 kW shall not exceed 3,000 calories (11,910 B.th.u.).

The plans for the power station were settled in October, 1919, and the contracts were placed in January, 1920. It was of supreme importance that the first generating sets should be at work during the winter of 1921-22, and the work was pressed on, in the face of great difficulties, with the utmost vigour. The successful result reflects the greatest credit on the engineers and contractors.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Cosmos" 2-kW Radiant Fire.

The question of obtaining the maximum amount of radiant heat from a given quantity of fuel or energy consumed is claiming the attention not only of the electrical manufacturers, but also of the foremost coal and gas-fire makers. The electrical industry, however, can more closely follow the laws of projection, in so far as it does not have to consider flues, chimneys, and other attendant evils necessary for combustion. These are dealt with by the station engineer, and the electric fire designer commences with the most concentrated form of heat—the electric current. Taking advantage of this fact, the Metropolitan-Vickers Electrical Co., Ltd., of Trafford Park, Manchester, has produced the "Cosmos" 2-kW fire to meet the demand for a general room-heating radiator; the main features of its construction are as follows:—

The reflector is constructed of hammered sheet copper, shaped to obtain the main projection of heat rays at an angle of about 40 deg. from the floor. The hammering, while greatly enhancing the appearance of the fire, especially when on

Fig. 1.—The "Cosmos" 2-kW Radiant Fire.

circuit, also ensures a greater dispersion of the radiant heat. The polished sides, of plain sheet copper, reflect the glowing hammer marks, and the cosy appearance is obtained at all angles of vision.

The bottom aperture is another entirely new feature. All other radiators, gas and electric, are constructed so that no heat is available on the floor or carpet immediately in front, and cold feet are not an uncommon affliction. The aperture allows the projection of heat rays to this portion of the room. Secondly, as 100 per cent. radiant efficiency is not obtainable, the fire is so designed that any convected currents of air applied to the best use. The opening allows a gentle flow of air to pass which strikes the back of the reflector, thus directing a slow circulation throughout the room which keeps the atmosphere in a healthy and pleasing condition.

From a purely heating aspect the excellence of the "Cosmos" cylindrical type of element is now well-known throughout the trade in connection with the "Cosmos" bowl fire. In the 2-kW fire the element is a self-contained part (fig. 2) and, by taking out the screws holding the connection box, can be withdrawn from the radiator frame. Connection is made by means of strong terminals mounted on a heavy porcelain block, two element sections (500 watts each) being straight on to the wall-plug control, and the remaining two element sections controlled by the s.p. rotary switch mounted on the

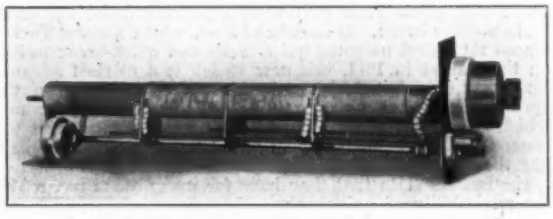


Fig. 2.—The "Cosmos" Heating Element.

fire. The object of having part of the fire controlled at the wall plug is to prevent "live" flexibles, when the fire is not in use. In order to replace an element section all that is necessary is to release the retaining nut at the opposite end of the element from the terminals, disconnect and spring the section out, insert the new section, reconnect, and tighten the screw.

In order to run this element at a high temperature, and so obtain the very high radiant efficiency which this fire possesses, a special resistance wire of exceptional quality is used. Life tests are being carried out, and after 2,000 burning hours the element is still perfectly satisfactory. Before the complete elements leave the factory they are flashed at 1,000 volts; a further flash test is made between the element and frame after complete assembly.

The general appearance of the fire is one of its best selling points. It was shown at the "Ideal Home" exhibition, and its cosy glow impressed us as being most attractive.

The construction of the guard has been carefully considered, and the utility of this part of the appliance will be readily appreciated. An ebonised handle is fitted to reverse the guard to form a trivet, and the guard is self-aligning so as to make proper contact with the supports. With the aid of this device the "Cosmos" 2-kW fire will boil a two-pint kettle of water in 15 minutes, and cooking operations such as grilling, frying, &c., can also be carried out.

The "Cosmos" fire only weighs 10 lb. complete, and a suitable lifting handle, heat-insulated, is fitted on the back of the reflector, rendering it extremely handy and portable from room to room.

A "Ford" Ignition System.

Some owners of "Ford" cars are dissatisfied with the form of ignition usually fitted owing to its complication. The substitution of a high-pressure magneto does not afford a satisfactory solution of the problem, as it is difficult to start up

Fig. 3.—The Runbaken "Ford" Ignition Unit.

the engine from cold unless battery ignition is used. For this reason the makers have purposely retained their original system, because it gives both magneto and battery ignition.

The Runbaken Magneto Co., Ltd., Cheetwood Road, Derby Street, Manchester, has devised a simplified dual ignition system. This utilises the magneto system already installed on the car. Instead of four coils and their accompanying tremblers, complicated connections, &c., a small neat transformer coil is used. There is only one contact breaker and one high-pressure distributor, both of which are readily accessible and simple in construction, being similar to those used on a magneto. The assembly (illustrated in fig. 3) includes transformer, distributor, interchangeable mounting plate, bolts, and cable, and no further additions are required.

Quick-make and Quick-break Tumbler Switches.

We have received from Messrs. J. H. Tucker & Co., Ltd., of King's Road, Tyseley, Birmingham, a sample of their latest production in tumbler switch manufacture, namely, a quick-make and quick-break switch with positive make and complete positive break. It is claimed that, whilst Messrs. Tucker placed their first patented quick-make and quick-break switch on the market in 1914, this new switch is a marked advance upon the type in which the action relies entirely upon the spring, which has only an "initial" positive action, and which may allow the switch arm to be withdrawn from the contacts but only sufficiently to just clear them without breaking the "arc."

The makers state that they have for many years recognised the advisability of quick-make-and-break switches under certain conditions, and have also realised the necessity of a complete positive make and complete positive break. This necessity might arise in any switch through other causes than failure of the spring itself, such as a mishap to the spring mechanism or damage to the contacts caused by any circumstances beyond the control of the manufacturer. For the past two years they have been engaged on producing an ideal combination embracing these features, and the sample before us (fig. 4) is the result of their efforts in this direction.

The spring is of the compression type, enclosed in a specially designed chamber forming in itself a complete "spring unit." In the unlikely event of the spring breaking it is still contained within the chamber and continues to function. A direct drive (quite apart from the spring or the spring

Fig. 4.—New "Tucker" quick-make and quick-break Tumbler Switch.

chamber) is obtained from the switch "dolly" to the contact arm, in such a manner as to cause the latter to travel its full extent in either direction, and the switch can consequently be placed in its correct "on" or "off" position, even if the entire spring mechanism is removed—a fact which we have verified.

In addition to the features above mentioned, many minor improvements are embodied in this new "Tucker" production. The contact clips are specially designed to give even contact to the switch arm, and are of flexible hardened copper, permanently fixed in their correct position by heavy brass clamping plates. To prevent the possibility of arcing across the contacts, an exceptionally high and wide dividing wall of china has been placed between them. The contacts are placed well away from the switch bridge and cover, so that arcing on to any dead part of the switch is impossible. With the object of obtaining a clear wide break, the cable clamping screw in the terminal has been reversed, so that it is impossible for this to shorten the arcing distance when the switch breaks, as it does not project towards the contacts. The reversing of this screw will also be appreciated by contractors generally, as it gives ample room for manipulation by an ordinary screw-driver without the risk of damaging the china.

The construction of the whole switch is extremely simple, and the mechanism is a combination of robust parts. Even the dolly pin and other rotating parts are properly machined pivots and screws, and the switch is thoroughly sound mechanically and electrically.

The F.B.I.—A petition has been presented praying for the grant of a charter of incorporation to the Federation of British Industries. Petitions for or against have to be delivered at the Privy Council Office, on or before May 5th

PARLIAMENTARY NOTES.

(By our Parliamentary Reporter.)

Electricity Supply.—On April 6th Mr. William Greenwood asked the total estimated cost of the administration of the Electricity Commissioners' department for the past year, and if the advisability of repealing Section 29 of the Electricity (Supply) Act, 1919, would be considered, as the expense of the Electricity Commissioners levied on the undertakers under this section was a direct tax on the electricity supply industry.

Mr. Neal (Parliamentary Secretary to the Ministry of Transport) said that the cost for the year 1921-2 was approximately £44,000. The answer to the second part of the question was in the negative.

Mr. William Greenwood asked whether a majority of the electricity supply undertakings in Lancashire had objected to setting up a Joint Electricity Authority under the 1919 Act and had substituted a scheme for an advisory board only.

Mr. Neal said that if the question referred to the whole of Lancashire the answer was in the negative. In the West Lancashire district a Joint Electricity Authority was to be formed under a scheme submitted by the authorised undertakers. In Mid-Lancashire an inquiry had not yet been held, but alternative schemes had been submitted: one for the setting-up of an Advisory Board and the other for constituting a Joint Electricity Authority. In South-East Lancashire proposals had been submitted by the undertakers to the Commissioners for the setting-up of an Advisory Board, and these proposals were under consideration.

Mr. William Greenwood asked whether the advisability of amending Section 19 of the Electricity (Supply) Act, 1919, would be considered, so as to provide that the transitory powers of the Electricity Commissioners would cease where an advisory board scheme instead of a Joint Electricity Authority had been set up in any electricity district.

Mr. Neal said he was advised that the powers mentioned might be of assistance to an Advisory Board, and he was therefore unable to recommend an alteration in the law in the sense indicated in the question.

Torquay Corporation (Electricity) Bill.—This Bill was read a second time in the House of Lords, on Monday.

Edinburgh Tramways.—In the House of Commons, on Monday, April 10th, Mr. William Graham asked the Parliamentary Secretary to the Ministry of Transport, whether he had received the report of the Commissioners appointed to inquire into the tramway problem in Princes Street, Edinburgh; and, if so, whether he could state the decision that had been reached.

Mr. Neal said that he had received the Report in question, and decided to adopt the recommendation therein contained, viz., that the request of the Corporation of Edinburgh for permission to put up centre poles to carry the overhead electrical equipment in Princes Street, and to alter the position of the rails on the northern side of the street should be granted.

CORRESPONDENCE.

***Letters received by us after 5 p.m. on Tuesday** cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Lock-out.

I have read your article in the current number of the Electrical Review on the present labour trouble, and I take strong exception to the tone of it. Of course, I do not for a moment deny that you are entitled to express your opinions, but at the same time I am quite at liberty to join issue and say that I do not agree with you.

Of course, if you restrict your reading to the views expressed by your contemporaries, the *Communist*, *Herald*, and similar publications, it is easy to understand that your opinion has been tinged with a certain colour, but I would venture to suggest that you read the series of articles that have been published from time to time in the *Daily Telegraph*, as well as those which appeared in the *Times*, before you hint that there is something behind the employers' lock-out which is not evident from the front.

Do you for a moment think that the responsible bodies of men who constitute the various Associations forming the Engineering Employers' Federation are anxious to go on paying their overhead charges and close down their productive activity for mere amusement?

Do you know that the whole reason for the lock-out is that an agreement on the management question was negotiated between the Executive of the employers and that of the Union and was turned down by a voting minority of only 20 per cent. of the membership of the A.E.U.?

You allude to the "arbitrary attitude adopted by the employers throughout the whole course of the trouble"; it is probable you may not be aware that in dealing with dele-

gates holding extreme views that any attitude other than that of firmness is immediately taken as an indication of weakness.

Are you also aware of the obstruction, to say the least, which the employers have had to endure at the hands of the extremists who very often control, although numerically in the minority, the feeling in the shop?

There is much more I could say. I am not writing to you for publication (although as far as I am concerned you are at liberty to do so), but having been a reader of your paper for so many years, I wish to express how much I resent the innuendos, not to say mis-statements, contained in the article alluded to.

I enclose you a pamphlet dealing with a number of instances affecting "management" which we employers justly complain of.

In conclusion, I should like to add that I welcome unions unbiased by politics, who can negotiate agreements and conditions and honour such agreements when made.

An Electrical Manufacturer.

April 10th, 1922.

I write to thank you for your sane and tolerant leader on this subject. The crisis demands plain words. It was, as everyone knows, prepared for, and led up to, by conversations between the representatives of the Employers and of the Trade Union on the subject of overtime—an altogether academic question to most of us, unfortunately. Then the issue was suddenly widened to "the right to exercise managerial functions," whatever the phrase may mean. There was, as you observe, a doubt "as to what lies behind it all." There is none now, for it is abundantly clear that Sir Allan Smith and his colleagues meant war.

It is known that the funds of the Unions are almost depleted, and the workers are poor: it is hardly magnanimous—to put the case mildly—for successful gentlemen to take advantage of the poverty of others, and to force them, through the suffering of their dependents, to accept humiliating terms. The effect on the minds of the workers will be evident to everyone not entirely devoid of imagination. It will tend neither to co-operation between employers and employed, nor to the increased production so much desired. Rather will it engender a deep-seated desire to revolt at the first opportunity. What does this matter, though? Are there not guns, aeroplanes and tanks here, as in South Africa . . ?

But why in the name of common sense should the employer take the *rôle* of the arrogant dictator? Prosperity does not lie that way, but rather through the exercise of reason and tolerance. Whatever faults he may meet with in his workmen, the fact remains that it is only by their co-operation—willing or unwilling—that he has attained his present position.

One can only hope that those employers who desire the co-operation and goodwill of workmen, and not the abject obedience of defeated and broken men, will see to it that their opinion is allowed some weight in the ultimate settlement.

S. Phaser.

April 10th, 1922.

Joints behind Switches.

Lead-covered cable is coming very much into use for house-wiring jobs; twin cable is generally used, but in practice I find that much unsatisfactory work is done by joint-making, which is generally done on the negative wire and packed in behind the switch base; this, besides being a very poor job, is also very troublesome.

I would suggest to the various switch manufacturers that they put a switch on the market arranged so that this negative joint may be taken on it, and carried through on a terminal, which could be suitably arranged on the switch.

Martin J. Coleman.

Ballaghadereen,
April 10th, 1922.

BUSINESS NOTES.

Bankruptcy Proceedings.—Jesse Frederick Ludlow and Robert Redvers Ludlow, trading in co-partnership as Ludlow Bros., 196, Church Road, Redfield, Bristol, electrical contractors.—The receiving order in this matter was made on March 29th on debtors' own petition. The statement of affairs shows liabilities of £307, against net assets of £53, or a deficiency of £254. Debtors attribute their failure to want of capital, bad trade and depreciation of stock. It appears that in October, 1919, with a total capital of £15, they started business as electrical contractors at their present address. The business does not seem to have been successful from the start, and they became aware of their position in March, 1921. A full set of books has not been kept.

Arthur Kershaw and Charles Herbert Wood, trading as Kershaw & Wood, 9, Bradford Road, Dewsbury, electrical engineers and merchants.—The application for discharge of these debtors was heard on April 5th at the County Court House, Dewsbury. The Official Receiver stated that they filed their petition in 1920, when the ranking liabilities amounted to £4,796 and the assets realised £1,437. A first and final dividend of 4s. in the £ was paid, and the debtors now offered to pay jointly a sum of £25 a quarter for two years, making a total of £200, for the benefit of the creditors. The discharge was granted, subject to the payment of the quarterly sums agreed to.

W. Camp (W. Camp & Co.), electrical engineer, Carr Lane, Slaithwaite, Huddersfield.—Receiving order made April 4th, on debtor's own petition. First meeting April 21st; public examination May 8th; both at the County Court House, Huddersfield.

Douglas C. Bate, electrical manufacturer and supplier, 16, John Dalton Street, Manchester.—Receiving order made April 4th, on debtor's own petition.

H. Oldfield, grocer, general dealer, and electrical engineer, 51, Milton Terrace, High Street, Heckmondwike.—First meeting April 20th; public examination May 4th; both at the County Court House, Dewsbury.

S. Beckett, Junior, electrician, 50, Deane Street, Bolton.—Last day for proofs for dividend, April 22nd. Trustee: Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

F. A. S. Wormull (Lewisham Electric Wiring Co.), electrical engineer, 273, High Street, Lewisham, S.E.—First and final dividend of 4s. 10½d. in the £, payable April 24th, at 29, Russell Square, W.C.1.

Company Liquidations.—Planet Electric Co., Ltd.—Particulars of claims to the liquidator, Mr. S. H. Swallow, 67, Broad Street Avenue, E.C., by May 8th.

Globe Electric Co., Ltd.—Meeting May 4th, at 119, Finsbury Pavement, E.C., to hear an account of the winding-up from the liquidator, Mr. W. A. Osborne.

B.E. Co. (of London and Birmingham), Ltd.—Meeting, April 20th, at Cannon Street Hotel, E.C. Liquidator, Mr. F. Rowland, 70, Queen Victoria Street, E.C.

Dissolutions of Partnership.—Thorpe, Willers Co., importers of electrical goods, hardware, cutlery, toys, &c., 78, Olympia Street, Burnley.—Messrs. G. Thorpe, H. H. C. J. L. Willers, H. Precious, and A. Precious have dissolved partnership.

Marylebone Electric Fittings Co., designers and manufacturers of electric light fittings, 4, Ramillies Place, Oxford Circus, W.—Mr. J. Leitch and Mr. T. Smith have dissolved partnership. Mr. Leitch will attend to debts and continue the business under the same style.

Brash & Russell, electrical, mechanical, and general engineers, 438, Baltic Street, Bridgeton, Glasgow.—Messrs. J. Brash and R. McL. Russell have dissolved partnership. Mr. Russell will attend to debts and carry on the business under his own name at 438, Baltic Street. Mr. Brash will carry on business temporarily at 65, Bath Street, Glasgow, during the completion of his new works, under the style of J. Brash and Co.

Trade Announcement.—The telephone number of the Sheffield branch of English Electric & Siemens Supplies, Ltd. (22, High Street, Sheffield), has been altered to Central 3535.

Catalogues and Lists.—Messrs. Simpson, Baker & Co., 2/5, Nelson Street, Bristol.—An illustrated net price list of electrical accessories of all kinds, including cables, wires, conduits, bells, pendants, shades, &c.

Messrs. Frost Bros., 26, Little Park Street, Coventry.—An illustrated booklet, describing "rotameters," for measuring the rate of flow of gases and liquids.

The Runbaken Magneto Co., Ltd., Cheetwood Lane, Derby Street, Manchester.—An illustrated pamphlet describing a new "Ford" ignition system.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflet O.S. 2706, giving illustrations and prices of "Osram" gasfilled "daylight" lamps for colour matching.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—An illustrated stock list (in French) of motors, dynamos, and transformers.

Berry's Electric, Ltd., 85, Newman Street, Oxford Street, W.1.—An illustrated and priced leaflet, describing the "Ortosafe" electric iron.

Messrs. Erskine, Heap & Co., Ltd., Australia House, Strand, W.C.2: Three pamphlets:—S.D.1, dealing with oil-immersed star-delta starters; A.T.1, oil-immersed auto-transformer starters; and R.S.1, oil-immersed rotor starters. All the gear described is fitted with no-voltage and overload trips; fully illustrated and priced.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Special publications, No. 7840/3, dealing with "Planer Drives," and No. 7874/2, "Power in the Textile Mill." These are well-illustrated and fully descriptive.

Private Arrangements.—T. G. Coaton, trading as T. G. Coaton & Co., electrical engineer, 16, Humberstone Road, Leicester.— The creditors were called together recently when a statement of affairs was presented which showed liabilities of £2,479. Of that amount £2,227 was due to unsecured creditors, and there were partly secured creditors for £396, who held securities valued at £144. After allowing £27 for preferential claims the assets were estimated to realise £798, or a deficiency of £1,681. It was reported that the debtor commenced business in 1912, in partnership with his brother, the capital being about £300. Subsequently they were joined by another partner who brought in £100. In 1919 the partnership was dissolved. At the date of the dissolution a balance sheet prepared showed a capital of £17,000. After discussing the position a resolution was passed to the effect that the debtor should execute a deed of composition to Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, London, E.C., to secure the payment of a composition of 10s. in the £, payable as to 5s. in three months, 2s. 6d. in six months, and 2s. 6d. in nine months. A committee was also appointed consisting of the representatives of Messrs. Drake & Gorham, Ltd., the British Thomson-Houston Co., Ltd., and the General Electric Co., Ltd.

Herbert D. Carter, Ltd., electrical contractors and ironmongers, Edison House, Colwyn Bay.—In response to a circular issued by the company, a meeting of the creditors of the above was held recently at Colwyn Bay. No statement of affairs was submitted, but it was stated that the company was a private limited liability concern which was formed in March, 1915, with a capital of £5,000, divided into 4,000 ordinary and 1,000 preference shares of the face value of £1 each. The whole of the preference shares had been issued, while 3,000 ordinary shares had been issued. Of the issued capital of £4,000, the greater amount was for a consideration other than cash. In September, 1917, Mr. Carter advanced £1,100 to the business and was given a first debenture. In September, 1921, a second debenture for £1,500 was created. Until 1920, the company carried on business as electrical engineers and the three largest creditors were for goods supplied in connection with such contracts. Since the date mentioned the company had also carried on business as ironmongers. A receiver had been appointed on behalf of the debenture-holders. The meeting had been called for the purpose of a report being submitted as to the position, but no definite resolution was passed.

Deed of Assignment.—Clayton Motors, Park Lane Mills, Chorley Lane, Leeds.—Mr. A. V. Clayton executed a deed of assignment on April 7th. A meeting of creditors was called for Tuesday, 11th inst., at Leeds, when a statement of affairs was to be submitted.

Book Notices.—We have received a copy of *Current Opinion*, the new official organ of the Industrial League and Council (3d.). It contains information regarding the work of the League and articles on "Unemployment Insurance," "An Industrial Parliament" (J. R. Clynes, M.P.), "Finding a Way Out" (Sir W. J. Noble), "Waste in Industry" (Prof. Spooner), and other matters. A supplement of eight pages contains an essay to wage-earners on "Fair Play," by Mr. James Smith, managing director of the Wellman Smith Owen Engineering Corporation, Ltd.

"*Journal* of the Institution of Electrical Engineers." Vol. LX., March, 1922, No. 307. This issue contains the following papers: "Utilisation of Exhaust Steam from Electric Generating Stations and Coal Economy," by Mr. C. I. Haden; "Utilisation of Waste Heat from Electrical Generating Stations," by Mr. F. H. Whysall; "Interconnection of Alternating-Current Power Stations," by Mr. L. Romero and Mr. J. B. Palmer; "A Method of Regulating the Voltages on the two sides of a Three-wire d.c. System Equalised by Static Balancers," by Mr. R. D. Archibald; "Single and Three-phase a.c. Commutator Motors with series and shunt characteristics," by Mr. S. P. Smith; "Test Results obtained from a Three-phase Shunt Commutator Motor," by Mr. F. J. Teago; "Determination of the Decrement of a Distant Station by means of a Coil Aerial," by Major J. Erskine-Murray and Mr. B Williams; and "Directional Transmission of Electro-Magnetic Waves for Navigation Purposes," by Major J. Erskine-Murray and Mr. J. Robinson.

"*Bulletin* of the Cleveland Technical Institute," Vol. I., No. 6 (66 pp.). Middlesbrough: The Institute. Containing abstracts of articles upon all branches of engineering and technology.

"A Course in Electrical Engineering," Vol. II., "Alternating Currents," by C. R. Dawes. Pp. xiv+526, figs. 406. Price 20s. "Economics of Electrical Distribution," by P. O. Reynau and H. P. Seelye. Pp. viii & 209, figs. 57. Price 12s. 6d. London: McGraw-Hill Publishing Co., Ltd.

Lead.—Reporting on April 8th, Messrs. James Forster and Co. say: "With regard to the future, we understand that there is a better demand for lead in the East, and it is not anticipated that any more supplies from Burma will be sent to this market for some time to come. Australian supplies will probably tend to decrease until the price of lead recovers still further. There is also a decidedly better demand being experienced for export than for some time past. We look for a continuance of the firm tone now prevailing, with a tendency for a further moderate advance in price."

For Sale.—By direction of the Disposal Board, Messrs. Eadon & Lockwood, will sell by auction at the National Ordnance and Filling Factory, Chilwell, Notts., on April 24th and 25th, plant and machinery, including four Lancashire boilers with superheaters and Bennis stokers, a 1,500-kW turbo-generator, electric cranes, &c.

The Corporations of Middlesbrough, Thornaby-on-Tees and Stockton-on-Tees, having taken over the undertaking of the Imperial Tramways, Ltd., in the three boroughs, invite offers for the portions of the land, buildings, machinery and plant not required by the Corporations in connection with the running of the tramway undertaking.

By direction of the Disposal Board, Messrs. Geering and Colyer will sell by auction on April 25th and following days, at Harty Ferry, near Faversham, electric motors, wireless instruments, &c. (See our advertisement pages to-day.)

Copper and Lead Prices.—Messrs. F. Smith & Co. report April 11th:—Copper (electrolytic) bars, £66 10s., £2 increase; ditto, ditto, sheets, no change; ditto, ditto, wire rods, £76 10s., £2 increase; ditto, ditto, h.c. wire, 9 15/16d., ¼d. increase; silicium bronze wire, 1s. 1¼d., ¼d. decrease.

Messrs. James & Shakespeare report April 11th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £23 10s., 10s. increase.

Canadian National Exhibition.—Although the annual Canadian National Exhibition, which is being held in Toronto from August 26th to September 9th, will not be a trade exhibition, as it is open to the public, it will provide an excellent opportunity for British manufacturers and merchants to display their wares to advantage. H.M. Trade Commissioner at Toronto states that to secure the maximum benefit from the show exhibitors should have a local branch or other selling organisation to ensure the following-up of inquiries, &c. He asks for catalogues and trade literature from manufacturers and others for distribution from the Bureau of Information, which is to be established in connection with the exhibition. Amongst the lists required are those connected with electric railway equipment; electrical machinery, appliances and equipment; mining machinery and supplies; textile machinery; industrial machinery; and scientific instruments. Catalogues, samples, &c., should be sent direct to H.M. Trade Commissioner at Toronto, 24, West Adelaide Street, Toronto.

Applications for British Trade Marks.—Appended we give a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Those who desire to enter an opposition to any of the applications have one month in which to do so from the dates given below:—

Lalley Light (lettering and design). No. 415,656. Class 6. Combined dynamo and engine for use in producing electric light and power. Lalley Light Corporation, 759, Bellevue Avenue, Detroit, U.S.A. (Herbert Haddan & Co., 31/32, Bedford Street, London, W.C.). March 29th, 1922.

Solstice. No. 421,096. Class 13. Electric metal filament lamps. John Sharwood Thomas, Faxfield House, 28, Watling Street, London, E.C. March 29th, 1922.

Figure Design. No. 419,641. Class 40. Electrical insulating compounds, of which bitumen is the predominating material. The Limmer & Trinidad Lake Asphalt Co., Ltd., 34, Victoria Street, London, S.W. March 29th, 1922.

Pasolite. No. 421,209. Class 6. Magneto electric machines and dynamos. J. W. Pickavant & Co., Ltd., Quickko Works, Lombard Street, Birmingham. April 5th, 1922.

Silvertown. No. 412,794. Class 8. Lightning protectors, vibrator sets for telephones, electric keys, pole changers (electrical), resistances (electrical), rheostats, relays (electrical), Leclanché cells, charged porous pots for Leclanché cells, and portable testing sets for cables. India Rubber, Gutta Percha and Telegraph Works, Ltd., 106, Cannon Street, London, E.C. April 5th, 1922.

Kemolite. No. 422,979. Class 11. Electric apparatus. Phyllis Earle, Ltd., 15, North Audley Street, London, W. April 5th, 1922.

Webwood. No. 422,125. Class 13. Electric switches, lampholders and electric fittings. Webb & Lewis (Engineering), Ltd., 109a, Russell Street, Birmingham. April 5th, 1922.

The "Ace" of Electrical Apparatus (lettering and design). No. 420,824. Class 13. An electric bedwarmer of sheet metal. Frederick G. Beale, trading as the Southern Electrical Co., 111, St. George's Park Avenue, Westcliff, Essex. April 5th, 1922.

Höhensonne. No. 421,346. Class 11. Mercury vapour and other lamps for medical and surgical use. Quarzlampen Gesellschaft, 1, Frankfurterland Strasse, Hanau-am-Main, Germany (Edwin Evans & Co., 27, Chancery Lane, London, W.C.). April 5th, 1922.

The A.E.G. and Trade in Esthonia.—Two foreign companies, the Allgemeine Elektricitäts Gesellschaft and Messrs. Prowodnik, have made applications for authority to open branches in Esthonia.—*Reuter* (Reval).

Electric Truck Contracts.—British Electric Vehicles, Ltd., has received an order from the Admiralty for seven special rail trucks, also one from the Spanish Railways for its standard model electric trucks. The company has recently supplied the Ebbw Vale Steel, Iron & Coal Co. with another six small electric locomotives, making a total of 14 in service.

Vandervell Magnetos.—Messrs. C. A. Vandervell & Co., Ltd., have converted their magneto factory at Brighton into one for the manufacture of small tools, and have transferred the magneto work to Acton, where all communications on the subject should be addressed.

Catalogues Wanted.—Mr. F. J. Barton, of 3, Alexandra Terrace, Dawlish, desires to receive price lists of small lighting sets and wiring material.

Brazilian Centenary Exhibition.—The British Section at this exhibition, which is to be held at Rio de Janeiro from September 7th to December 31st next, in celebration of the centenary of Brazilian independence, is being organised by the Department of Overseas Trade. Realising that many British firms which could do good business there cannot at present afford the sum necessary to exhibit the actual goods on the scale required, the Department has made arrangements for the display of such goods by means of models, kinema films, lantern slides and lumiere plates. Lumiere plates, which are coloured reproductions on glass, lend themselves particularly well to the display of such articles as fabrics, jewellery, pottery, and so on. An idea of their effectiveness for exhibition purposes can be obtained in the offices of the Department of Overseas Trade, at 35, Old Queen Street, Westminster, where an exhibition in miniature has been constructed to show what can be done on these lines.

Meters for Canada.—H.M. Trade Commissioner at Winnipeg has received an inquiry from Vancouver, British Columbia, for supplies of electricity meters. The annual demand for electricity meters in Vancouver is stated to amount to about five thousand, delivery of which runs into about four hundred per month, all the year round. The type required is a bottom-connected single-phase, watt-hour meter, the sizes ranging from 10 amps. to 800 amps. The 10-amp. size is in greatest demand, and now costs $8.75 laid down at Vancouver, all charges paid. The inquirers are anxious to receive in duplicate from United Kingdom manufacturers full particulars and lowest prices. Documents, which give full information relative to the type of meters which are in use in British Columbia, have been received in the Department of Overseas Trade in London, in connection with this inquiry, and can be seen on application at Room 49, where the name and address of the inquiriers can also be obtained.

New French Company.—La Société Union Electrique du Bassin de la Loire (U.E.L.) is the name of a new company which has lately been formed in Paris (73, Boulevard Haussmann) with a capital of 4,000,000 fr.

Trade Films.—At the Stoll Picture Theatre on April 6th, the London Press Exchange, Ltd., gave an exhibition of a number of films dealing in various ways with well-known commodities. The "message" of each film was effectively hidden in a "story," ensuring the interest of the public, who would not be content to sit through the exhibition of a mere advertisement. Among the films shown was "The Economist"—a romance of the "Osram" lamp.

Social Event.—The Union Cable Sports and Social Club held a social and dance in their Works' Canteen on Saturday last. In the afternoon the Football Club played their last League match of the season, Henley's Athletic Club being the opponents. The visiting team won by two goals to nil. After the match the two teams and their friends sat down to a cold spread, which was followed by a concert and dance. The Union Cable Sports and Social Club has held many social functions, the previous one being a dinner and theatre party on March 24th, at which the staff entertained the general manager.

LIGHTING AND POWER NOTES.

Ashton.—Electricity Supply.—The District Council has received applications from various local bodies for permission to take a supply of electricity from the South Lancashire Tramway Co. Permission has been refused, and the question has been deferred for three months. Meanwhile the town clerk has been instructed to obtain particulars as to taking a bulk supply of electricity.

Abram (Lancs.).—Electricity Supply.—The Council is to obtain particulars from the South Lancashire Tramways Co., as to the terms upon which the company would be willing to supply the district with electricity.

Australia.—Perth.—It is proposed to spend an additional £175,000 upon new plant and equipment for the East Perth Government power station.

Tenterfield (N.S.W.).—The residents have had placed before them a hydro-electric scheme. The alternative proposals, which have been advanced by an expert, will cost from £30,000 to £35,000 each.

Stawell (Vic.).—The Borough Council is to borrow £12,500 shortly in order that it may proceed with a scheme for generating electricity for the township.—*Reuter's Trade Service* (Melbourne).

Lismore (N.S.W.).—Application is being made by the Municipal Council for sanction to the borrowing of £35,000 in connection with the electricity scheme.

Barrow.—Extensions.—The Electricity Committee has appointed a sub-committee to deal with the question of extending the electricity supply to the urban districts of Ulverston and Dalton.

Blackpool.—Extensions.—The Corporation is to spend £106,000 on extensions to the electricity works during the next twelve months.

Bradford.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £14,980 by the Corporation for converting plant, &c., for the electricity undertaking.

Bridgend.—New Plant.—The Urban District Council has decided to overhaul and install new plant at the electricity works, at a cost of £6,500.

Coleraine.—Electricity Scheme.—The Honourable the Irish Society, London, which has property rights in Coleraine district, Co. Derry, has refused to continue negotiations with the Urban Council with regard to the latter's proposals to rent the water-power at the Cutts, on the River Bann for the purpose of generating electricity. The Society states that the loss caused to salmon fishing would be considerable. At a recent meeting of the Council, it was decided to point out to the Society that turbines had been installed on other rivers without damage to the fisheries.

Continental.—France.—An intercommunal network is to be set up in the Ardennes, the communes of the cantons of Rumigny, Rocroi, Signy-le-Petit, and Chaumont-Porcien having formed themselves into a trust for the purpose. It is intended to erect the main station at Liart, a second at Maubert-Fontaine, and a third at Roquigny. Seventy-one communes will be interested, and the estimated outlay is 4,500,000 fr.

An important electrical scheme is about to be taken in hand in the Départements du Centre et de l'Ouest in connection with the development of the basin of the Dordogne River. The departments have been divided for the purpose into economic regions, and these into sections and groups. The Inter-regional Commission, which has the control of these matters, has favourably entertained the demand for a concession from the Clermont region, which has accordingly begun its operations.

Russia.—The Russian Trade Delegation reports that a company has been formed, participated in by the Berlin Electrical Co., to re-equip Kiew with power stations and tramways.—*Reuter's Trade Service.*

Denbigh.—Electricity Supply.—The residents are being canvassed with a view to ascertaining the number who would be prepared to take a supply of electricity if the borough were connected to the main cable of the North Wales Power and Traction Co.

Dundee.—Bulk Supply.—The Electricity Committee has approached the Hydro-Electric Development Co., Ltd., with a view to obtaining a supply of electricity. The company stated that if the Corporation was prepared to lease its station the company would undertake to relieve it of the capital charges, interest, and sinking fund. It would also undertake to supply electricity at as cheap a rate as that at which the Corporation could supply, and if the Corporation thought it was desirable to extend its area of supply, the company would be agreeable to give an extended supply. The figures quoted by the company were £3 7s. 6d. per kW of maximum demand, plus .2d. per unit. Mr. Richardson, the Corporation engineer, said the price quoted was not lower than that at which electricity could be produced by the Electricity Department at present. It was recommended that the Town Council should consider the principle of combination between the company and the Electricity Department, provided financial terms favourable to the city could be arranged.

Hawkshead.—Electricity Supply.—The Electric Light Committee is circularising the district to ascertain the demand for electricity. Two schemes are proposed, one costing £1,200 and the other involving an outlay of £2,000.

Hazel Grove and Bramhall.—Electricity in Bulk.—At a recent meeting of the Stockport Town Council, the electrical engineer submitted a letter from Mr. T. L. Miller, consulting engineer, asking if the Corporation was prepared to give a supply to the Hazel Grove and Bramhall urban district. It was resolved that the writer be informed that the Corporation was prepared to furnish a bulk supply of electricity for distribution by the Urban Council.

Horsham.—Reduced Charges.—The Urban District Council has reduced the charges for electricity for lighting from 8d. to 7½d. per unit, and for power by ½d. per unit, the reductions to take effect as from the March meter readings.

India.—Water-power Scheme.—The Punjab Hydro-Electric Power Supply Co., Ltd., has been formed to develop and work the Rosul, Dhimber Weir, Gujranwalla and Joyanwalla falls of the Punjab canal. The four falls will develop a total of about 34,000 h.p.—*Reuter's Trade Service* (Bombay).

Kilmarnock.—Extended Supply.—The Town Council has been granted a special order authorising it to supply electricity to places outside the borough, including the Burghs of Ardrossan, Saltcoats, Kilwinning, Stewarton, and Cumnock.

Maidenhead.—Loan.—The Town Council has applied for a loan of £5,300 for extensions to the generating plant.

Marlborough.—Order Revoked.—The Minister of Transport has revoked the Marlborough Electric Lighting Order, 1913, as to the whole of the area of supply as from April 5th, 1922.

Navan.—Inquiry.—An inquiry into the application of the Urban Council for a loan of £10,000 to carry out an electric lighting scheme will be held by a Provisional Government inspector in the Council Chamber on the 22nd inst.

New Zealand.—Auckland.—An important stage has now been reached in the negotiations between the Government and the City Council, with a view to the immedjate prosecution of the Arapuni hydro-electric scheme, which involves damming the Mikato River. It is estimated that the first stage of 50,000 h.p. will cost £130,500 for the head works, and £574,000 for the main transmission system throughout Auckland and Taranaki provinces. It is hoped eventually to develop 162,000 h.p. The Government will complete the constructional work within six years, if an agreement can be reached with Auckland with regard to the quantity of energy which it can promise to consume.

Price Reductions.—Reductions are to be made in the charges for electricity in the following districts:—Dewsbury, Wakefield, and Watford.

Salford.—New Power Station.—The Special Committee, which has had under consideration the advisability of proceeding with the erection of a new generating station at Agecroft, estimated to cost about £750,000, has decided that the Agecroft scheme should be proceeded with immediately, and that the services of Mr. J. A. Robertson shall be retained as consultant. It is expected that the work will take from two to two and a half years to complete, until which time Salford will draw a carry-over supply from Manchester. The agreement by which a bulk supply is delivered from the city will terminate in October, and the Salford Town Council is to be asked to agree to two years' extension of the period, when it is expected that the Agecroft supply will become available. At a meeting held on April 10th, the above recommendations were adopted by the Council.

Stretford.—Electricity in Bulk.—The Urban District Council is applying to the Manchester Corporation for a bulk supply of electricity.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—Track Renewals.—The Corporation proposes to relay tramway track during the next 12 months at a cost of £97,000.

Running Powers.—The Tramways and Electricity Committee has agreed that the agreement at present in force between the Corporation and the St. Annes Urban District Council as to the latter's tramway running powers in the borough shall be continued for a further three months.

Continental.—France.—The suburban railway from Paris to Trappes, which is owned by the State, is to be electrified, and the work is expected to take two years to complete, although a portion of the line has already been partly converted. Tenders are now being considered for the supply of 30 electric locomotives at an estimated cost of 14,000,000 fr.

Liverpool.—Loan Sanctioned.—The Tramways Committee has received from the Ministry of Transport sanction to the borrowing of £132,200 for the reconstruction and doubling of the Liverpool and Prescot Light Railway.

London.—"Underground" Holiday Fares.—For the four days of the Easter recess the "Underground" companies are issuing special cheap return day-tickets to Hampstead and Golders Green, from most of their stations.

The Position of the L.C.C. Tramways.—In its report to the London County Council upon the London traffic problem, the Highways Committee states that one of the chief obstacles the Council has encountered in the working of the tramways has been the persistent opposition to its endeavours to link up and develop the tramways as a complete system, adapted to the needs of the whole area. The system consists of 15 separate undertakings which have been acquired since 1894. In seeking powers to link these up, the Council has been obstructed by local authorities, and, in fact, out of the 186 miles of line which the Council has desired to construct since 1901, about 110 miles has not even been considered by Parliament. The Committee considers that the time has come when the Government should give every possible assistance to the Council in alleviating the present traffic troubles.

St. Helens.—New Route.—The Town Council has agreed to the recommendations of the Tramways Committee to lay a double line of track from Croppers Hill to the borough boundary and to relay the track in Church Street. Application is to be made for sanction to borrow £40,000 for carrying out the work.

Wolverhampton.—Revised Fares.—The Corporation Tramways Committee has decided to recommend that the 2d. minimum ordinary fare should be reduced to 1½d., and that the other fares remain as at present, the revised minimum to become operative as soon as arrangements can be made.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Wireless Telegraphy.—Mr. Fish, chairman of the Amalgamated Wireless Co., says that the Australian station corresponding to stations in England and Canada will be completed in two years' time. At the Australian main station the aerial will be rigged on 24 towers, each 800 ft. high, covering nearly two square miles of ground. The plant for the main station will be imported from Great Britain, and the plant for the State feeder stations, it is hoped, will be made in Australia. The site of the main station will be somewhere near Melbourne or Sydney.—*Morning Post.*

Wireless Telephony.—Broadcasting.—In reply to a question in Parliament on the subject of broadcasting wireless telephone messages, the Postmaster-General said that the whole question was being referred to the Imperial Communications Committee. The Postmaster-General stated that he was entirely sympathetic with the idea.—*Daily Mail.*

Finland.—Wireless Telephony.—As was mentioned several months ago, the South Finland Interurban Telephone Co. had applied to the Finnish Government for a concession to establish a wireless telephone service between Helsingfors and Stockholm, and a similar concession was being sought in Sweden by the Svenska Radio Co. In Finland the question was referred by the Council of State to the military authorities and the telegraph administration; the former has recommended the approval of the scheme, but the latter have not yet presented a report. It appears, however, that the Telegraph Administration desires to have a telephone system between Finland and Stockholm in its own hands, by means of a cable, and for the purpose of inquiry a representative recently paid a visit to Stockholm. It is estimated that a cable would involve an expenditure of from 20,000,000 to 40,000,000 Finnish marks, whereas a wireless station for telephony would amount to 1,000,000 marks. The question remains unsettled.

Telegrams from Helsingfors report that a preliminary agreement has been reached for laying a telephone cable between Stockholm and Helsingfors, comprising nine lines. The agreement has been made, and says that the project has only been investigated. It is possible that radio-telephony may take the place of the proposed cable.—*Reuter's Trade Service* (Stockholm).

French Africa.—Wireless Telegraphy.—The key of the wireless system in the Sahara is the station of Colomb-Bechar, set up in 1917. The first plant had a capacity of 2 kVA, but there are now installed two 10-kVA alternators. The station has a heavy traffic with the whole of the West Saharan region—Adadla, Taghit, Igli, Beni-Abbas, Tabelbala, Timimoum, and Abrad—with alternative routes to Bon-Denib and Oran on occasions of interruption of communications; and a daily service to Batna and Timbuctoo when weather permits. Communication with the Eiffel Tower and Lyons is also made on occasion. There is now being installed a big station at Ain-el-Hadjar on the Perezam to Colomb-Bechar railway, which will afford communication with France and Algeria.

Italy.—Wireless Telegraphy.—A concession has been asked for to erect a wireless station for the transmission of news throughout Italy. The station will be set up near Rome, and styled the "Araldo" (Herald). It will have a capacity of 5 kW, and be able to transmit messages over a distance of 1,000 km. It is not proposed to occupy the Hertzian field for more than from 100 to 120 minutes in 14 hours.

The Telephone Service.—Party Lines.—The G.P.O. authorities are considering the possibilities of a new telephone party line, says the *Daily Mail*. Mr. David Pelton Moore, the representative for the Hastings system, which has been successfully carried out in the United States, said: "Our system is designed to enable the exchange to call each individual subscriber on a party-line and to give him a private line in precisely the same manner as with the present single line. From two to twenty-four subscribers can be placed on a single line. "By checking traffic conditions of single lines and adding a sufficient number of subscribers, it is possible to reduce the cost from 50 to 75 per cent., while affording to each subscriber a secret and uninterrupted service. The present plant will serve with the addition of a few essentials."

Automatic Equipment at Newcastle.—Sir William Noble, Engineer-in-Chief to the General Post Office, in an address to the Newcastle and Gateshead Chamber of Commerce on March 28th, said it had been decided to change the existing plant in Newcastle by substituting automatic equipment. The first exchanges to be dealt with would be the Central and City, Newcastle and Gateshead. The territory at present served by the Central and City would be in future divided between one large automatic exchange to be called the Central, and two smaller ones, named East and West. Plans were now in hand for three new exchange buildings on the north side of the Tyne, and the building at Gateshead was in course of erection. Immediately the buildings were ready, installation work would be commenced. The reconstruction of plant at the remaining exchanges within the five-mile radius would be undertaken from time to time as might be necessary.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Argentina.—Buenos Aires.—June 28th. Municipal Council. Plant for hydro-electric generating station and transformer sub-station.*

May 10th. 37,000 metres of 6,600-V cable and 10,000 miles 2,200-V cable.

Australia.—Melbourne.—May 11th. Victorian Electricity Commissioners. 960 miles of aluminium steel-cored cable; 3,000 lb. flat armoured wire; 4,000 lb. No. 4 tie wire.

July 5th. Victorian Railways. Three passenger electric elevators and one freight elevator with all equipment.—*Reuter's Trade Service* (Melbourne).

September 1st. Victorian Electricity Commissioners. Five surface feed-water heaters, six surface vapour condensers, and 12 feed-water evaporators.—*Reuter's Trade Service* (Melbourne).

May 23rd. Porous cells, &c.*

July 5th. Victorian Railways. One 2-ton storage battery truck with jib crane and lifting magnet.

Belgium.—Brussels.—April 15th. Post Office authorities. Terminal boxes for telephone cables.

April 19th. Supply and laying 1,990 metres telephone cable at Boom and Alost.

April 26th. 18,000 metres of telephone cable for Ghent.

Brighton.—May 8th. Electricity Department. One 6,000-kW turbo-alternator and exciter with condenser, and one geared turbo-driven d.c. generating plant. (April 7th.)

Bury.—April 15th. Electricity Department. 1,000 yd. of cast-iron pipes, 3 ft. 6 in. internal diameter, construction of intake chamber, and all contingent works between Tottington railway bridge and power station, Chamber Hall. Mr. J. Amsworth Settle, borough engineer.

Clydebank.—Electric lighting installation for premises in Miller Street for the County Education authority. Clerk to the authority, 18, Park Circus, Charing Cross, Glasgow.

Dundee.—April 20th. Electricity Department. Steelwork for Craigie sub-station. Burgh engineer.

Edinburgh—April 24th. Tramways Department. 70 trucks and electrical equipment of cars, also wheels and axles. Tramway manager, 2, St. James' Square, Edinburgh.

Glasgow.—May 1st. Electricity Department. Cables, meters, and carbons, for 12 months. (See this issue.)

Hornsey.—April 20th. Electricity Department. One cooling tower. (March 31st.)

London.—Stepney.—April 20th. Electricity Supply Department. Three 1,000-kW converting sets and one 50-ton electrically driven overhead gantry crane. (March 31st.)

H.M. Office of Works.—May 4th. Engineering labour (electrical, &c.) required in the Newcastle-on-Tyne and Southampton districts during a period of three years. Secretary, H.M. Office of Works (Contracts Branch), King Charles Street, London, S.W.1.

Metropolitan Asylums Board.—April 26th. Installation of two electric automatic passenger lifts and two electric automatic service lifts at Tooting Bec Mental Hospital, &c. (April 7th.)

Manchester.—Electric lighting installation at St. Stephen's Church, Harpurhey. F. Rutter, 76, Carisbrook Street, Harpurhey.

New Zealand.—Auckland.—June 1st. Tramways Department. Electric equipment for ten bogie tramcars.—*Reuter's Trade Service* (Melbourne).

Wellington.—July 8th. Public Works Department. Eight steel transmission line towers.

Salford.—Electrically-driven detritus dredgers and/or reciprocating pumps for sewage disposal works, Weaste. James Diggle & Son, civil engineers, 14, Brown Street, Manchester.

Siam.—Bangkok.—June 5th. Department of Posts and Telegraphs. Telegraph and telephone materials, about £10,000. Chief electrical engineer, Telephone Exchange, Bangkok.*

Warrington.—April 18th. Electricity Department. H. and l.t. paper and lead-covered cable. (March 31st.)

April 18th. Electricity and Tramways Committee. Tramway pole-planting wagon. Mr. F. V. L. Matthias, borough electrical and tramway engineer. Electricity Works, Warrington.

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Barrow.—Electricity Department. Stores for three months. Accepted:—

Insulating tape, &c.—Metropolitan-Vickers Electrical Co., Ltd.
Insulating compound, e.h.p. ditto, &c.—British Insulated & Helsby Cables, Ltd.
Bitumen.—Dussek Bitumen Co.
Pin plugs.—A. P. Lundberg & Sons.
Lampholders, tumbler switches, adapter plugs, &c.—General Electric Co., Ltd.
Fuse wire, half-watt lamps, and carbon filament lamps.—Edison Swan Electric Co., Ltd.
A.c. and d.c. electric meters.—Chamberlain & Hookham, Ltd.
Earthenware pipes and troughs.—Doulton & Co.
Casing and capping.—Downes & Davies.
Meter boards.—E. Last & Sons.
Lead seals.—Acme Lead Seal Co.
Copper wire.—Johnson & Beckwith, Ltd.

Belgium.—Belgian Post Office. We are informed that the following tenders were received for the supply and laying in of 1,500 metres of telephone cable at Tournai, Mouseron, and Bruges:—

Comp. Industrielle des Téléphones, Paris	42,230.28 fr.
Ateliers de Constructions Electriques de Charleroi ...	49,105.72 fr.
Compagnie Générale des Cables, Lyons	52,150.72 fr.
A. Cailleaux et Cie., Brussels	65,571 fr.
W. T. Henley's Telegraph Works, London, 66,345 fr., c.i.f., Antwerp.	
Electric Cables & Conduits Co., Schaerbeek	69,057 fr.
A. Keiffner, Schaerbeek	71,160 fr.
Siemens & Halske, Berlin	82,812 fr.

We understand that the following tenders were submitted to the Brussels Corporation for cables and accessories:—

A.C.E.C., Charleroi	2,105,704.35 fr.
Câbleries d'Eupen	2,172,901.65 fr.
Câbleries de Presbourg	2,559,148 fr.
Metropolitan-Vickers	3,281,336 fr.
Bell Telephone	3,637,679.06 fr.
Câbleries de Lyon	Unit prices.
Prescott	,,
Zurich	,,

Bolton.—Electricity Committee. Accepted:—

Switchgear extensions at Back o' th' Bank generating station and Spa Road sub-station.—Bertram Thomas.

Tramways Committee.

Eight new tramcar equipments.—English Electric Co., Ltd.

Bradford.—Electricity Committee.

500 5-amp. single-phase a.c. meters.—Thompson & Co.
Electrical installation at new offices and showrooms of the Electricity Department, Sunbridge Road.—Jessop & Boydell, Ltd.
Cast-steel nozzle box for vertical turbine.—British Thomson-Houston Co., Ltd.
Feed-water piping for boiler-house, Valley Road works.—Aiton & Co., Ltd.

Dublin.—Electricity and Public Lighting Committee. Accepted:—

Supply of transformers for 12 months (approx. amount £7,000).—British Electric Transformer Co., Ltd.

Edinburgh.—The Town Council has disapproved of the Tramway Committee's recommendation (mentioned in our last issue) to allot rail and pole contracts to German firms, and the successful firms are:—

Steel tramway rails and fishplates (£1,527).—Dorman, Long & Co.
Three-piece tramway steel poles.—Stewart & Lloyds, Ltd.
Tramway car top covers (£4,300).—Craven's Railway Carriage & Wagon Co., Ltd., London.

The recommendation was rejected by 30 votes to 19, and the main argument advanced for the British tenders to be accepted was the need for keeping trade in this country.

Liverpool.—Corporation. Accepted:—

100 40-h.p. D.K. 20a motors, including roller bearings.—English Electric Co., Ltd.

London.—Stepney:—Electricity Committee. Coal for the Electricity Department:—

Two barges Scotch (Wemyss) washed pea nuts (24s. 10d. ton).—J. Hudson and Co. (accepted).
Wood flooring in new test room (£106).—Acme Flooring & Paving Co. (1904), Ltd. (accepted).
One ton plumber's solder (£69).—G. W. Neale (accepted).
Gunmetal multi-jet nozzle heater (£55).—G. & J. Weir, Ltd. (recommended).
Carbon-dioxide indicating outfit (£53).—Cambridge & Paul Instrument Co., Ltd. (recommended).
Electrically-operated adding machine, with motor and drive (£252).—Burrough's Adding Machine, Ltd. (recommended).

St. Marylebone.—Electricity Committee. Recommended. In connection with the supply of electricity to Messrs. Peter Robinson, Ltd., Bourne & Hollingsworth, Ltd., and Debenham, Ltd.

Transformers (£3,537).—British Electric Transformer Co., Ltd.
E.h.p. switchgear (£2,688).—Ferguson, Pailin, Ltd.
Circulating-water mains and feed-water pipes (£3,940).—Aiton & Co., Ltd
Valves (£1,928).—J. Blakeborough & Son, Ltd.
Cast-iron pipes (£515).—Davis & Slack, Ltd.
Water-softening plant (£1,950).—Becco Engineering & Chemical Co., Ltd.
E.h.p. switchgear for Hampstead bulk supply (£1,021).—Ferguson, Pailin, Ltd.

Supply of cable for 12 months:—

Enfield Ediswan Cable Works, Ltd. (recommended) ...	**£20,918**
Hackbridge Cable Co., Ltd.	22,321
Macintosh Cable Co., Ltd.	23,922
Henley's (W. T.) Tele. Works Co., Ltd.	23,950
Siemens Bros. & Co., Ltd.	24,260
Glover (W. T.) & Co., Ltd.	24,347
British Ins. & Helsby Cables, Ltd.	24,376
Western Electric Co., Ltd.	24,457
Pirelli-General Cable Works, Ltd.	24,872
Callender's Cable & Const. Co., Ltd.	25,854
India Rubber, G. P. & Tele. Works Co., Ltd.	Unable to tender.
St. Helen's Cable Co., Ltd.	Unable to tender.

Constructional steel work for Osborn Street sub-station (£74).—Redpath, Brown & Co. (recommended).

Maidenhead.—Town Council. Accepted:—

One 4-cylinder vertical heavy oil engine, with 250-kW dynamo and equipment, for the electricity works (£5,239).—Ruston & Hornsby, Ltd.

Maidstone.—Town Council. Accepted:—

Twenty-five "Xcel" electric irons for hiring purposes.—Drake & Gorham (Wholesale), Ltd.

Transformers (£128).—Ferranti, Ltd.

New Zealand.—Mangahao.—Hydro-electric scheme. The Government has accepted the tender of Metropolitan-Vickers Electrical Co., at £30,764, for switchgear. The Mangahao installation will have the highest electrical pressure in Australasia. The lowest tender received was one for £24,666 from America.—*Reuter's Trade Service* (Wellington).

The following tender has been accepted by the Public Works Department of the New Zealand Government:—

Seven 4,000-kVA, 110,000-volt, single-phase, oil-immersed, forced-cooled transformers, in connection with the Mangahao hydro-electric power scheme.—Ferranti, Ltd.

Reading.—The following contracts have been placed by Messrs. May & Hawes, consulting engineers, on behalf of the Reading Electric Supply Co., Ltd.:—

1,500-kW, three-phase Belliss-English Electric turbo-alternator and condenser.—Belliss & Morcom, Ltd.

1,000-kW rotary converter.—The English Electric Co., Ltd.

Wolverhampton.—Electricity Committee. Accepted:—

Ash bunkers and conveyor trough (£490).—A. H. Guest & Co.

Two 40,000-lb. water-tube boilers, with superheaters complete (£8,508).—The Stirling Boiler Co., Ltd.

Four self-contained forced-draught travelling grate stokers complete (£6,122).—The Underfeed Stoker Co.

Stand-by telpher coal grab for the present telpher machine (£295).—Strachan & Henshaw, Ltd.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (East-Midland Sub-Centre).—Tuesday, April 18th. At the College, Loughborough. At 6.45 p.m. Paper on "Electric Vehicles," by Mr. R. J. Mitchell.

(Sheffield Sub-Centre).—Wednesday, April 19th. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Ordinary meeting. Visit of President and smoking concert.

Institute of Cost and Works Accountants.—Wednesday, April 19th. At the Institute of Patent Agents, Staple Inn Buildings, W.C. At 7 p.m. Last meeting of the session. Paper on "Treatment of On-Costs with particular reference to Machine Rates," by Mr. R. Townsend.

Institution of Railway Signal Engineers.—Thursday, April 20th. At the Institution of Electrical Engineers, Victoria Embankment, S.W. At 3 p.m. Paper on "The Location of Signals as an Aid to Traffic Working," by Mr. R. S. Proud.

Electrical Power Engineers' Association (Southern Division).—Friday, April 21st. At the Essex Hall, Strand, W.C. At 7 p.m. General meeting.

Junior Institution of Engineers.—Friday, April 21st. At Caxton Hall, S.W. At 8 p.m. Paper on "Condenser and Choke Coil Protective Apparatus," by Mr. S. A. Stigant.

NOTES.

The Lead-Hydrate Battery.—The article which appeared exclusively in our issue of March 24th on the lead-hydrate storage battery has attracted much attention. It has been represented to us from a certain source that a catalogue issued by the makers gives particulars only of cells which, so far as capacity per lb. is concerned, show no advantage compared with cells of the ordinary type, the data not being in accordance with the remarkable claims put forward and quoted, on the makers' responsibility, in the article. Further, we are informed that batteries purchased from the makers show no higher capacity than other makes, that their quotations in answer to inquiries do not offer higher capacities, and in fact that the high-capacity batteries referred to in the article are not available for purchase.

In view of these statements, we have inquired of Messrs. Siebe, Gorman & Co., Ltd., and have received from them the following letter, dated April 11th:—

"In reply to your letter of to-day's date, we beg to state that up to the present we have only delivered to customers starter batteries for motor cars. These starter batteries do not require abnormally high capacity, but, on the other hand, they do require a low internal resistance so that a big initial discharge can be obtained. This is the case with all batteries supplied up to the present, and they should not therefore be compared with the batteries as put forward in your article of March 24th, in which it is stated that such high capacity batteries have an output of about 30 watt-hours per lb. The ordinary high-capacity battery is rated at about 12 to 15 watt-hours per lb.

"The company is prepared to supply batteries giving, approximately, this high capacity, in accordance with the circular issued by them. This result has been definitely established by actual experiment, which we are prepared to demonstrate immediately before the Editors of the Review or their own technical representative.

"We are, Gentlemen,

"Yours faithfully,

"*For* Siebe, Gorman & Co., Ltd.,

"H. Trevor Dawson, *Director*."

To prevent misunderstanding, we have ascertained from the company that the high-capacity batteries which they are prepared to supply are those giving 30 watt-hours per pound.

Wireless Telegraphists' Dispute.—In consequence of a dispute, about 300 wireless operators in the employment of the Marconi International Marine Communication Co., Ltd., at Bristol Channel ports ceased work on Thursday. Mr. F. Davies, South Wales district secretary of the Association of Wireless Telegraphists, to which the operators belong, stated that they were prepared to accept the small wage reduction proposed, but they definitely refused to undertake any extra duties, such as tallying, in addition to their telegraphic work, on the ground that it was outside their agreement with the Marconi Co. He was hopeful that negotiations would soon be resumed. Pickets have been posted at the docks at London and Liverpool and the North-East Coast and Bristol Channel ports, with the result that many wireless telegraphists have refused to sign ships' articles.

Educational.—University College, London.—Professor J. A. Fleming has been compelled by illness to cancel all engagements for the present, and will consequently be unable to deliver the course of lectures on "Modern Improvements in Telephony" at University College which had been announced to begin on April 26th. It is hoped that Professor Fleming will be able to deliver the course in October.

Polytechnic, Regent Street, London.—Electrical Engineering Department.—Special courses of six lectures, each commencing May 8th, will be given during the summer term, on the following subjects: Electric lighting and illumination, power factor and its improvement, alternating current measurements, protection of e.h.p. systems, and industrial electrical measuring instruments. Fee for the course, 7s. 6d. Full particulars are given in our advertisement columns to-day.

Bradford Municipal Technical College.—The authorities have arranged a special course of indoor lectures and, where suitable, out-door practices, in various subjects, including wireless telegraphy (every Thursday, commencing May 18th), by Mr. H. G. Evans, M.Sc., and scientific and industrial magnetic measurements (every Tuesday, commencing May 16th), by Mr. S. Barlett, B.Sc.

Fatalities.—An inquest was held on April 4th into the death of William Whitehouse, a fitter's mate, employed by the Worcester Electricity Department. Evidence showed that the deceased went beneath a mechanical stoker to make an adjustment when he was caught by a wheel on some shafting, and killed. The Chairman of the Corporation Electricity Committee said that if it were possible to devise a suitable screen to prevent such an accident in future, it would be installed. A verdict of "Accidental death" was returned.

On April 8th an employé of the Leeds electricity works, George Brown, came into contact with some "live" metal while working on a switchboard, with fatal results.

Appointments Vacant.—Senior assistant electrical engineers (shift duties) (£250), for the Newcastle-on-Tyne Electric Supply Co., Ltd.; sub-station attendant (87s. 3d.), for the Stoke Newington Borough Council electricity department. (See our advertisement pages to-day.)

The Electricity (Supply) Bill, 1922.—The Report stage of the Bill was taken in the House of Lords on Tuesday last. The Earl of Bessborough moved an amendment to Clause 1, restricting the borrowing powers of joint electricity authorities to a maximum of £100,000, except when Parliamentary sanction was obtained.

Viscount Peel said the amendment would cripple the authorities, and proposed an amendment in substitution for it providing that the maximum amount that might be borrowed by an authority should be specified in the scheme constituting the authority.

Lord Monkbretton, on behalf of the L.C.C., said that Lord Bessborough's amendment would destroy the Bill, and if the Bill were not passed in its present form, the L.C.C. would have to reconsider the proposed extension of tenure of the London companies.

Lord Bessborough's amendment was withdrawn and Viscount Peel's adopted. An amendment to Clause 16 exempting those members of a joint electricity authority who did not take a supply of electricity from liability to make good any deficiency was agreed to, and the Report stage was concluded.

The Incorporated Association of Electric Power Companies, representing thirteen of these companies in Great Britain, has issued a memorandum setting forth the position of the companies under the Electricity (Supply) Bill, 1922. It is regarded as essential that a measure of protection should be given, and the Association contends that the operation of Joint Electricity Authorities should be excluded from the power companies' areas. No local authority in the area of a power company should be permitted to contribute to the expenses of a Joint Authority, but power should be given to such an authority to grant financial assistance to the company in certain circumstances. It is complained that there is no guarantee in the Bill that a Joint Electricity Authority will be under an obligation to supply power at a lower rate than or as low a rate as that charged by an existing undertaker in the area. In apportioning the expenses of the Electricity Commissioners, the basis should be "units sold" not "units generated," and bulk supplies should be specially treated so that distributors would also be assessed for a fair proportion of expenses; under the present Bill, distributors would apparently escape any contribution.

Standard Specification for Tramway Rails.—The British Engineering Standards Association has issued a revised edition (No. 2—1922) of the Standard Specification for Tramway Rails and Fishplates, originally issued in 1903. The principal modifications are set out in a preface. In the manufacture of rails by the Bessemer and open hearth processes, both acid and basic, a higher minimum carbon content is specified, and in the case of "basic" rails added silicon has been provided for. The minimum tensile strength of rails has been increased to 45 tons per sq. in. Testing procedure is set out in detail, and an arbitration clause has been added. Section 8 is a special heavy section designed for use in exceptional traffic conditions; and Section 9 is primarily intended for interurban tramways employing sleeper construction.

Service Notes.—*Territorial Army Reserve—Engineers.*—Major A. J. Dickinson, A.M.I.E.E., T.D., having attained the age limit, was retired on April 5th. He retains the rank of Major.

General List.—R.E.—Capt. H. L. Bazalgette, A.M.I.C.E., A.M.I.E.E., from the London Electrical Engineers, takes the rank of captain as from April 5th.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Dinner.—Arrangements have been made for the members of the Institution to dine together at the Engineers' Club after the ordinary meeting of the Institution, to be held on April 27th. The charge per cover will be 5s. 6d. Members wishing to be present at the dinner are requested to send their names to the Secretary in advance either in writing or by telephone.

Conversazione.—The annual conversazione will be held at the Natural History Museum, South Kensington, on June 29th.

North-Western Centre.—The annual general meeting of the Centre is to be held on April 25th, at the Engineers' Club, Manchester, when the annual report will be presented, and the election of a chairman, two vice-chairmen, honorary secretary, and four ordinary members of committee will take place.

Aberdeen Sub-Centre.—The number of members in the district does not warrant the continuance of this Sub-Centre, and the Institution Council has, therefore, decided to dissolve it.

New Students' Sections.—The Institution Council has approved of the formation of Students' Sections at Leeds and Sheffield.

Institution of Engineers (India).—The first volume of the *Journal* of the Institution is of particular interest as it gives a concise review of the circumstances which led up to the formation of the Institution, its constitution, and future prospects, by the Organising Secretary (Mr. Hugh W. Brady, M.I.Mech.E.). A full report of the inaugural ceremony, including the presidential address by Sir Rajendra Nath Mookerjee, K.C.I.E., is also given. The volume embodies the first annual report and an account of the first annual general meeting, and it is satisfactory to note from the former that it is improbable that the loan offered to the Institution by the Government of India will be required. Six papers are contained in the *Journal*, dealing respectively with "The Howrah Bridge Problem," "Light Railways," "Electro-Chemical Industries," "Portland Cement," "Driving Belts," and "The Patent System." The subscription for the *Journal* is 50 rupees per annum.

The second annual general meeting was held early in January, when Major G. H. Willis, C.I.E., M.V.O., R.E., M.I.Mech.E., was elected president. Major Willis is Master of the Bombay Mint, and has been for some time President of the Bombay Association of the Institution.

Institution of Production Engineers.—A general meeting of the Institution will be held on April 21st, at the Institution of Mechanical Engineers, when Mr. J. R. Smith, A.M.I.E.E., chief electrical engineer to Messrs. J. & E. Hall, Ltd., Dartford, will deliver a paper, to be illustrated by lantern slides, dealing with "Electricity in a Machine Shop."

Liverpool Engineering Society.—On April 5th Mr. Sterry B. Freeman, C.B.E., read a paper entitled "Some Remarks on Turbine Gearing." The paper dealt with the marine aspect of the subject and compared first of all the steam turbine with the oil engine for ship propulsion. Then such considerations as gear-cutting, the material employed, the wearing of gears, &c., were taken, the author giving instances which had come to his notice.

Institute of Metals.—A ballot for the election of members and student members of the Institute will be held on Wednesday, April 19th. The twelfth annual May lecture is to be delivered on May 3rd, by Prof. Sir Ernest Rutherford, F.R.S., on "The Relation of the Elements." Membership application forms and cards of invitation to the lecture may be obtained on application to Mr. G. Shaw Scott, M.Sc., the Secretary, 36, Victoria Street, S.W.1.

Edinburgh Electrical Society.—At the meeting on March 24th, Mr. J. McEwan Brown, of the Post Office Telephones, delivered a lecture on "Magnets." On April 7th, Mr. J. Walker read a paper entitled "Notes on a.c. and d.c. Plant," which was illustrated by a large number of lantern slides, and dealt chiefly with maintenance questions.

Members who intended to visit the Walkerburn Hydro-Electric Works on Saturday, April 22nd, were invited to send their names to the secretary so that arrangements might be made for transport, &c.

Glasgow Corporation Engineering Society.—The Glasgow Corporation Electricity Department Engineering Society brought a very successful session to a close on April 3rd, when a paper on "Heat Balance" was read by Mr. John Bruce. This paper won the prize offered at the beginning of the session by the management, for the best essay on the subject. The Society has now a membership of 300, and the monthly meetings are well attended.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

We learn with interest that, in consequence of a reorganisation of the Jackson Electric Stove Co., Ltd., Mr. W. A. Gillott, A.M.I.E.E., is severing his connection with that company. Mr. Gillott is in the exceptional position of a fully qualified power transmission engineer who has turned his attention to the development side of the electricity supply industry, with remarkable success; of the 14 years that he was connected with the Newcastle-on-Tyne Electric Supply Co., Ltd., he spent some eight years in developing electric heating and cooking over the whole of the company's area, with a free hand, the result being a profitable load of 15,000 kW. His paper on the subject before the I.E.E. led to the formation of the Electrical Development Association, of the council and committees of which he is an active member, and during 1918-19 he was in control of the electrical work in connection with the National Kitchens and Restaurants under Lord Rhondda. In 1920 Mr. Gillott, at the invitation of the Jackson Electric Stove Co., Ltd., joined that concern as sales manager, in which capacity, amongst other achievements, he initiated the use of electricity for cooking on the Great Northern Railway trains which we recently described, besides carrying on a propaganda which has benefited the industry generally. His private address is "Dunsinane," Hadley Road, New Barnet, Herts.

Major-General Sir Frederick Sykes has been elected a director of the Underground Electric Railways of London.

The Special Committee of the Salford Corporation appointed to consider the Electricity Committee's proposals submitted at Monday's Council meeting a recommendation that the Council should appoint Mr. J. A. Robertson as engineer "to design and direct the construction of the new electricity generating station at Agecroft and the laying of the necessary main transmission lines, at an inclusive remuneration of £14,000, together with reasonable travelling expenses, on condition that the inclusive fee shall include the fees and expenses of an architect and other necessary technical assistants, and the cost of the preparation of all necessary plans, &c." According to the *Manchester Guardian* it was further recommended that for a period of twelve months from April 1st instant Mr. Robertson should be appointed consulting engineer to the Corporation in connection with the existing electricity undertaking at an inclusive fee of £500 per annum, the Corporation reserving power to renew the appointment at the end of the period stated. The Council on Monday adopted the above recommendation.

In the King's Bench Division, on Monday, the settlement of the libel action, brought by Sir Philip Dawson, M.P., against Lord Alfred Douglas, and a paper called "Plain English," was mentioned. The libel appeared in that paper while Sir Philip was standing as Conservative candidate for Lewisham, last August. Lord Alfred Douglas said he was away at the time and had nothing to do with the appearance of the libel. The other parties concerned apologised and paid a sum of money into Court.

Mr. H. Dickinson, the Liverpool City electrical engineer, is to be responsible for the duties of City Lighting Engineer and Official Inspector of existing electric meters. Mr. W. H. Wardle, principal assistant in the Liverpool Electric Lighting Department, has been recommended for an increase in his present salary from £300 per annum plus E.P.E.A. bonus, to £350 plus Corporation bonus.

Mr. H. J. B. Chapple has been appointed lecturer in electrical engineering at the Bradford Municipal Technical College at £370 per annum.

Mr. Johnstone Wright, Bradford, has been appointed City electrical engineer at Belfast in succession to Mr. Bloxam, who is retiring on pension. Mr. Wright received his technical training in mechanical and electrical engineering at Glasgow

Technical College, began his professinoal career as construction and testing engineer to the British Electric Plant Co., Alloa, and was afterwards chief assistant at the Oban Electricity Works. Between 1906 and 1919 he filled several important position in the Cleveland, Durham and Newcastle-on-Tyne group of power companies. In September, 1919, he was appointed deputy electrical engineer of Bradford.

Mr. G. L. F. Philips, who has just retired as manager of the N. V. Philips Gloeilampen Fabrieken, has been elected a director of the company. In place of Mr. G. Swope, of New York, Mr. J. W. Woodward, of Paris, one of the European managers of the International General Electric Co., has also been appointed a director of the Philips company.

We regret to learn that Prof. J. A. Fleming has been compelled on account of illness to cancel all engagements for the present. We trust that he will speedily recover his normal health.

Mr. R. H. Pitts, O.B.E., has been appointed to act as Staff Officer for the Underground companies. Mr. Pitts will hold this post in addition to his duties as secretary to the Joint Standing Committee of the companies.

Obituary.—Mr. J. N. Paxman.—We announced in our last issue the death of Mr. James Noah Paxman, one of the founders of the firm of Davey, Paxman & Co., Ltd., Standard Ironworks, Colchester. The firm was inaugurated in the year 1865, by Mr. Charles M. Davey, Mr. Paxman, and Mr. Henry Davey, at premises in Culver Street, in the centre of Colchester, but its growth was so rapid that in 1876 a larger and more convenient site was found at the Hythe, much closer to the river than the original works, and it was there that Mr. Paxman's chief work was carried out, for, two years later, the Daveys retired from the business, and the subsequent development of the firm was due, in the main, to him. In 1869 he patented the "Paxman" vertical boiler, and in 1878 his automatic cut-off gear. At the International Electric Exhibition, held in London, in 1882, Mr. Paxman's engine ran so steadily and perfectly that it was retained by the jury for carrying out their experiments; they commended it for its efficient and regular performances, and awarded him a gold medal. From 1880 onwards the "Paxman" plant for the supply of electricity for lighting has been a feature of every British exhibition, notably at all those held at Earl's Court, London; a large plant also figured at the Paris Exhibition, of 1889. Among other specialities, Mr. Paxman experimented with the dry-back flue and tubular boiler, and after a series of trials put on the market his well-known "Economic" boiler, a boiler noted for its economy, and widely used. Notwithstanding his active engineering practice, Mr. Paxman devoted much time to the welfare of Colchester, and the County of Essex. He was on two occasions Mayor of the borough and acted as High Sheriff of the County in 1903 and 1904. His benefactions to the town of Colchester include substantial help to the Technical School for Science and Art, the gift of part of the public park, the Victoria Tower of the Town Hall, and the tower of St. Leonard's Church. At the time of his death he was in his 91st year, and, though failing health obliged him to live far from the works, his mental faculties were unimpaired, and up to the last he remained in close touch with the business of his company.

Mr. James Noah Paxman.

Mr. J. J. Easton.—We regret to learn that Mr. J. J. Easton passed away at Sidmouth, Devon, on April 7th, at the age of 73 years. Mr. Easton entered Messrs. Siemens Brothers' offices at 3, Great George Street, Westminster, in 1868, at the age of 19, and remained with the firm and with the succeeding company—Siemens Brothers & Co., Ltd.,—until June, 1919, when he retired. During this period of 51 years, he was largely instrumental in furthering the growth of the company's business, and for many years had charge of its commercial organisation in relation to all classes of cables and telegraphy. Mr. Easton was a keen business man, was happy in his family surroundings, and found in fishing his great hobby and recreation.

Mrs. J. A. Robertson.—Our readers will learn with regret of the death of Mrs. Robertson, wife of Mr. J. A. Robertson, borough electrical engineer of Salford, after an illness which commenced suddenly in September last. Mr. Robertson has lately been passing through a period of keen distress in this regard, having to divide his attentions between his wife, critically ill at Greenock, where she had been taken in the hope that the change would do her good, and the Salford Corporation discussions regarding his appointment. We desire to pass on to him our own and our readers' sympathy with him in his great bereavement.

Sir John Benn.—We regret to record that Sir John Williams Benn, Bart., passed away on Monday morning, at his residence in Surrey, at the age of 72 years. Sir John had been a man prominent in public affairs for the greater part of his life, but to us and to our readers he is best known by reason of his lengthy connection with the London County Council (especially the part he played in connection with its electric tramway system), and through his interest in the trade Press. The Benn interest in trade journals was latterly owned and developed under the style of Benn Bros., Ltd., which owns among other papers *The Electrician* and the *Hardware Trade Journal*. Of this company, Sir John was chairman, and Mr. Ernest J. P. Benn, the eldest son and heir, who now assumes the title, is managing director.

Wills.—The late Sir George Carter (Cammell, Laird and Co., Ltd.) left £20,755 gross, and net personalty nil.

Mr. H. S. J. Booth, managing director of the Electrophone, Ltd., left £6,929 gross, and £6,030 net personalty.

NEW COMPANIES REGISTERED.

British Horo-Electric, Ltd. (180,855).—Private company. Registered April 3rd. Capital, £50,000 in £1 shares. To adopt agreements (1) with H. Bingguelev and F. G. Trollope and (2) with the Compagnie Générale Horo-Electriques; to develop and turn to account the inventions, patents and rights comprised in the first agreement, and to carry on the business of manufacturers of and dealers in electrical and other watches, chronometers, clocks, timepieces and horological instruments, &c. The first directors are: F. G. Trollope, 17, Bolton Street, W.1, gentleman; L. W. N. Hickley, Much Hadham, Herts, solicitor; M. P. Favre-Bulle, B'd Beausilaur, Paris; H. Bingguelev, 1, Montague Street, W.C.1, manufacturer; Lt.-Col. H. W. Snow, 52, Chester Terrace, S.W.1. Qualification: £100. Remuneration (except managing director), £500 per annum divided between them. Secretary: V. G. Frohman, 34, Waldgrave Road, Ealing, W.5. Solicitors: Clowe, Hickley & Heaver, 10, King's Bench Walk, Temple, E.C.

Metals Reproduction, Ltd. (180,811).—Private company. Registered March 31st. Capital, £15,000 in £1 shares. To acquire any inventions relating to the reproduction of metals; and in particular to acquire from Sherard Cowper Coles the benefit of certain discoveries or inventions, to carry on any business relating to above or to the reproduction, working, manufacture, development or improvement of any metal, metalliferous or other products or any chemical, synthetic or other substitute for the same, &c. The permanent directors are: Cecil H. Nicholson, 96, Piccadilly, W.1; Sherard Cowper Coles, Rossall House, Sunbury-on-Thames; Frank de Fontaine England, 10, Porchester Place, Hyde Park, W. Qualification: £100. Remuneration: £150 each per annum. Secretary: F. de F. England. Registered office: 40, Grosvenor Place, W.

Kilrush Electric Lighting and Power Co., Ltd.—Private company. Registered in Dublin March 31st. Capital, £5,300 in £1 shares. To carry on at Kilrush the business of an electric light company in all its branches. The subscribers are: D. Ryan, Kilrush, miller, 500 shares; T. J. Mahony, Kilrush, hardware merchant, 1,000; G. Brew, Henry Street, Kilrush, hardware merchant, 100; J. Saunders, Moore Street, Kilrush, boot merchant, 100; P. O'Shea, Moore Street, Kilrush, draper, 200; P. Tubridy, Francis Street, Kilrush, civil engineer, 100; G. J. Cantwell, 6, Fleet Street, Dublin, engineer, 250. The first directors are the above subscribers and D. G. J. Cantwell. Registered office: Burton Street, Kilrush.

Standard Carbon Brush Holder Co.—The Standard Carbon Brush Holder Co., Ltd., was registered on April 1st as a company limited by guarantee, with 20 members each liable for £10 in the event of winding up. The objects are: to acquire from W. H. Scott and A. A. Pollock patent No. 140,913, of 1920, for an invention relating to improvements in current collecting devices for dynamo-electric machines, and to carry on the business of electrical engineers and contractors, manufacturers of and dealers in electric, magnetic, galvanic and other apparatus, &c. The management is vested in an Executive Committee, the first members of which are: H. T. Boothroyd, Ltd. (H. T. Boothroyd, governing director), Bootle, Liverpool; British Thomson-Houston Co., Ltd. (M. C. Lusk), Rugby; Lancashire Dynamo and Motor Co., Ltd. (A. P. Wood, managing director), Trafford Park, Manchester; Mather and Platt, Ltd. (E. Roberts, director), Park Works, Manchester; Laurence, Scott and Co., Ltd. (W. H. Scott, director), Norwich; Brush Electrical Engineering Co., Ltd. (W. Johnstone, executive director), Loughborough; Metropolitan-Vickers Electrical Co., Ltd. (R. S. Hilton), Trafford Park, Manchester; Electromotors, Ltd. (B. Longbottom, managing director), Openshaw, Manchester. Solicitors: T. Trimmell, 71, Lincoln's Inn Fields, W.C. No notice of situation of registered office was filed at time of incorporation. The file number is 120,842.

Spensers, Ltd. (180,818).—Private company.—Registered March 31st. Capital, £12,000 in £1 shares. To carry on the business of manufacturers of and dealers in electrical plant, machinery, meters, apparatus and appliances, producers and suppliers of electricity, electrical, mechanical, hydraulic and general engineers, &c. The first directors are: H. E. Smith, Attadale, Bush Hill Park, Enfield; K. Smith, St. Lawrence, Millway, Mill Hill, N.W.7; C. K. Black, Milton, Stanmore, Middlesex. Secretary: C. Kennedy Black. Registered office: 6, London Street, Paddington.

Macdonald Brown, Ltd. (180,840).—Private company. Registered April 1st. Capital, £250 in £1 shares. To carry on the business of electrical, mechanical and general engineers, &c. The first directors are: H. Holt, 14, Queensborough Terrace, Bayswater, W.; F. T. Warne, 4, Rosemary Avenue, Church End, Finchley, N. Secretary: H. C. Mundy. Registered office: 39, Furnival Street, Holborn, E.C.4.

A. Peckston, Ltd. (180,849).—Private company. Registered April 3rd. Capital, £1,000 in £1 shares. To take over the business of an electrical engineer carried on by Austin Peckston at 42, Wilson Street, Middlesbrough. The permanent directors are: A. Peckston, 3, West View, Acklam Road, Linthorpe, Middlesbrough (managing director); A .W. Foster, "Wynneholme," The Avenue, Marton-in-Cleveland, Yorks. Registered office: 42, Wilson Street, Middlesbrough.

Dunblane and District Electricity Supply Co., Ltd. (12,127).—Registered in Edinburgh March 30th. Capital, £15,000 in £1 shares. To carry on the business of an electric light, heat and power supply company, &c. The first directors are: A. H. Anderson, The Firs, Dunblane, estate factor; D. C. Blair, Cluny, Dunblane, merchant; H. Marshall, Stirling Arms Hotel, Dunblane, hotel proprietor; J. A. Stirling, Kippendavie, Dunblane, landed proprietor; A. B. Wilson, St. Bryde's, Dunblane, manufacturer. Minimum cash subscription: £3,500. Qualification: £250. Secretary: J. L. Cox. Registered office: Park Cottage, Pisgah, Dunblane.

Anti-Vibration Electric Lamp Co., Ltd. (180,973).—Private company. Registered April 6th. Capital, £500 in £1 shares. To carry on the business of manufacturers, exporters and importers of and dealers in electric, gas, and lighting goods and accessories, &c. The subscribers (each with one share) are:—W. Lennard, 3, Love Lane, Eastcheap, E.C.3 merchant; R. C. Radeglia, 3, Love Lane, Eastcheap, E.C.3, merchant. The subscribers are to appoint the first directors. Solicitors: H. Crafter & Co., 7, Southampton Street, W.C.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Falk, Stadelmann & Co., Ltd. (23,743).—Return dated January 12th, 1922. Capital, £650,000 in £1 shares (365,000 preference and 285,000 ordinary). 351,238 preference and 268,317 ordinary shares taken up. £248,816 paid. £370,739 considered as paid. Mortgages and charges, £80,000.

Cape Electric Tramways, Ltd. (54,686).—Return dated December 28th, 1921. Capital, £500,000 in £1 shares. 491,222 taken up. £91,222 paid. £400,000 considered as paid. Mortgages and charges, £225,000.

New Phonopore Telephone Co., Ltd. (44,654).—Return dated December 26th, 1921. Capital, £10,000 in 9,000 ordinary and 1,000 founders' shares of £1 each. 7,141 ordinary and 1,000 founders' shares taken up. £1 per share called up on 6,741 ordinary shares. £6,731 paid, leaving £10 in arrears. £1,400 considered as paid on 1,000 founders' and 400 ordinary. Mortgages and charges, £2,566 13s. 4d.

CITY NOTES.

Metropolitan-Vickers Electrical Co., Ltd.

Mr. J. Annan Bryce (Chairman) presided at the annual meeting, held on April 5th, at 4, Central Buildings, Westminster. In the course of his remarks on the balance sheet, he said that sundry creditors at £1,386,707, compared with last year's figure of £2,244,062, and showed the substantial reduction of £857,355. This reduction was partly due to a decrease in the number of new orders received during the year as compared with those taken in 1920, and partly to the increased efficiency caused by working on narrower margins of material. General reserve account had been increased by a further £100,000. The balance carried forward, £92,815, showed an increase of £33,991 as compared with 1920. On the other side of the balance sheet stock and materials on hand represented £1,977,032, compared with £2,788,941, a decrease of £811,909. This diminution was due to the same causes as in the case of the item sundry creditors. Sundry debtors, £1,969,885, showed a reduction of £58,996, mainly resulting from the efficiency of the collections department. That there had been no greater reduction was a satisfactory feature of the business. It showed that there was a large amount of work on hand, the results of which would appear in future accounts. Cash in hand and at bankers, £455,685, compared with £245,709. This substantial increase of £209,976 arose partly from the realisation of certain investments, and partly from the fact that cash tended to accumulate as orders fell off. Coming to the profit and loss account, the profit available for the year was £440,342, or nearly £40,000 in excess of 1920. This was satisfactory in view of the depression in trade during the year. Orders received were considerably fewer than in the preceding year, but they were able to keep the shops fully employed owing to the number of orders remaining unexecuted at the beginning of the period. It was still too early in the current year to form an opinion as to prospects. There had lately been a considerable decline in orders, but the electrical industry did not feel the effects of the depression as soon as most other industries did, and they were still working on orders received some time ago, which were likely to show comparatively favourable results. The same could not be said of most of the orders recently taken. For these there had been keen competition, the object being to keep works as fully employed as possible. One large order, running into about a million pounds, for the supply of electrical railway equipment to the South African Government, they had been fortunate enough to secure during the current year in face of severe competition from both America and the Continent. Their traction department, of which Mr. P. S. Turner was the head, was to be congratulated on the work that it did in obtaining this order. Till lately there had been some prospects of a brighter day for the industries of the country. Cheaper money was beginning to encourage investment. Food prices, and with them the cost of living, were falling. With the larger output and lower prices of coal there had come a revival in the export of that staple, and signs of an increased demand in the metal and other industries. In their particular industry a renewal of activity was expected in connection with the schemes for co-ordination of power supply and electrification of railways, in the orders for which the company, with technical equipment second to none, was entitled to hope for a fair share. But the sky had suddenly become overcast. The dispute in the engineering trade, now extended to the allied trades, had thrown a cloud over the prospects of a revival of industry, and it might be long before the horizon was clear. The occasion of the dispute was the question of overtime, but the real issue was whether the management of an enterprise was to be in the hands of the employer or of the workman. It was a vital issue, which did not admit of compromise. The circumstances of the dispute were remarkable. At the ballot of the Amalgamated Engineers only about 20 per cent. seem to have voted, and there was reason to believe that the smallness of the vote was due to many members not having received notice of the ballot. It was a curious feature of industrial, as of political life, that the extremists or die-hard elements, though insignificant in numbers, so often succeeded by violent or unscrupulous methods in imposing their will on the more moderate man. So long as the moderate man suffered himself to be overborne by the violent, so long would industrial equilibrium be unattainable. It may, perhaps, be held that these recurring spasms of industrial unrest, however deplorable, were the inevitable concomitants of readjustment after the terrible upheaval caused by the war. No less formidable were other corollaries of that upheaval—the clash of nationalities—the burden of taxation—the chaos of exchanges. Let them hope that the Conference of Genoa might have better guidance among these problems than the Conference of Paris. There would be no peace, either for nations or for industries, so long as they forgot that all were members of one body. With regard to the internal activities of the company, he had before him reports by the works manager (Mr. Bailey), the research and education manager (Mr. Fleming), the superintendent of labour (Mr. Walmsley), the superintendent of women workers (Miss Wilson), the works committee, the staff committee, and the Women Workers' Committee, of which Mr. Ratcliffe, Mr. Rostron, and Mrs. Miller and Mrs. Egan were the respective chairmen. All the reports bore witness to the continuance of the most cordial harmony between the management and the workers. It had always been the policy of the administration to inquire into and discuss with the workers any complaints or grievances they might have with a view to amicable settlement. Of late years this policy had been greatly facilitated by the establishment of a works committee elected by the workers, with one of themselves as chairman. The sittings of this committee were attended by a representative of the management, and at the meeting there were not only discussions of complaints and grievances, but valuable suggestions for the more efficient conduct of the business were often made by the workers themselves. From time to time attempts had been made by extremists from outside to stir up mischief, but these attempts had always failed, and no industrial dispute had ever originated in their factory. While the policy of harmonious working had always been a feature of their administration, he was happy to be able to assure them that it had never been so marked a feature as under the wise handling of the managing director (Captain Hilton), who had succeeded in infusing the whole administration from top to bottom with his own kindly human spirit. This year the task had been specially difficult. The decline in orders had entailed a reduction in the amount of employment, but great pains had been taken to spread the work so as to displace as few as possible and to provide employment for those who, by long or good service, had most claim for consideration. The output of the year had been the largest during the history of the company, exceeding by 35 per cent. the output of 1919. This high degree of efficiency was obtained in spite of a decrease in the number of workmen, and of delay caused by the coal strike, to meet which some of the boiler furnaces were converted to oil firing. The average rate of wages showed a slight decrease from that of 1920, but was still about double the pre-war rate. The Chairman proceeded to give details of the working of the Benevolent Fund, the Provident Fund, and the Workmen's Canteen, and referred to the activities of the Research and Education Departments. Reference was made also to the death of Sir Francis Barker, and the chairman said it had been decided to invite Mr. Douglas Vickers, head of the great organisation which bore his name, to take the vacant place on the board.

Mr. A. Spencer seconded the motion, and the report was adopted without discussion.

The retiring directors and auditors having been re-elected, the chairman proposed a vote of thanks to Captain Hilton (managing director), Mr. Bailey (works manager), to Messrs. Rand and McKinstry and Lloyd (Sales and Export Departments), Messrs. Peck and Baumann (Engineering Department), Mr. Cooke (comptroller), and Miss Wilson (superintendent of women). He referred also to the valuable services rendered by the secretarial staff in London, at the head of which was Mr. Scanes, who, like himself, had been connected with the company from its inception, indeed, they were the two oldest inhabitants.

The motion was carried and briefly acknowledged by Capt. Hilton.

The Brush Electrical Engineering Co., Ltd.

The annual meeting was held at 88, Kingsway, London, W.C., on Monday. Mr. E. Garcke, who presided, said the directors were glad to be able to report a further substantial improvement in the general prosperity of the company. In view of the marked improvement, it might be interesting to compare the recent advances with the year immediately preceding the war. For the year ended December, 1913, the profit shown by the audited accounts, after deducting interest on debenture stocks, expenses of management and maintenance, but before charging depreciation, was £20,061. For the last year of the war, 1918, the corresponding figure was £89,053. For 1919 it was £146,640. For 1920 it was £189,052; and for the past year, 1921, it was £230,557. In the course of his review of the accounts, the speaker said that the item "patents and goodwill" was being gradually written down, but it was quite a nominal figure considering the increased value of their patent rights. Their stock of goods and materials on hand and work in progress showed a considerable reduction. It was only £401,000, compared with close on £600,000 in the preceding balance sheet. That accounted for the improved financial position, for they had converted a large part of their stock into amounts owing to them or into actual cash. The amounts owing to them were £355,000, compared with £226,000 in the preceding balance sheet. Their shares and debentures in other companies stood at the low figure of £5,934. The general charges were about £3,600 higher, but the maintenance of buildings had cost them less. They had paid away less for interest on debentures and bank loans, and on the other side there was a very substantial increase in the gross profits. Taking it altogether, he thought this was the best balance sheet which the company had issued since its reconstruction 34 years ago. It was not easy, under present conditions, to obtain a clear view of what the future might bring forth. At the present time they had a very substantial amount of work in hand, and with the anticipated revival of business they were justified in looking to the future with confidence, always provided, of course, that the labour unions recognised the altered circumstances of to-day and settled down to production under conditions permitting of successful competition for work both at home and abroad. Mr. Garcke continued: "The present dispute with the Amalgamated Engineering Union on the right of employers to exercise full managerial functions in their own factories is naturally affecting work in our shops, as the great bulk of our skilled workmen are out. The dispute seemed likely to extend to other unions, whose members by ballot voted in support of the A.E.U. attitude, but later developments have led to the suspension of the notice given to the members of these other unions, and there seems to be some probability of a stoppage being avoided in their case. But whatever the result of the negotiations now pending with these allied unions may be, it will be impossible for us, and for many other engineering firms who are similarly situated, to keep our works open for long in the absence of so large a proportion of skilled mechanics, and if the members of the Amalgamated Engineering Union do not return to work soon it will become a question with many firms either of shutting down completely or endeavouring to replace the skilled men by training others to do their work." On previous occasions he had referred to the development of their Brush-Ljungstrom turbo-generator plant, and had drawn attention to the change which the installation of this plant had brought about in the fortunes of certain electricity supply undertakings. The merits of the design were now generally recognised, and evidence of the economies which it effected in steam consumption continued to accumulate. If they examined the latest complete returns of all electricity supply stations in Great Britain, large and small, generating by steam, they would find that the average cost of fuel per unit sold was .935d., or rather less than one penny per unit. On this basis every 1/10th of a penny per unit in fuel costs meant a difference of £1,000,000 in the coal consumption of the public electricity supply stations of Great Britain. Besides its high efficiency the Brush-Ljungstrom turbine plant had other features to recommend it, and with these advantages he thought they might look forward to the further development of this section of their business. The new shop they were completing for turbine manufacture was a very fine building 504 ft. long by 80 ft. wide in one span, and 45 ft. high to the eaves, which would increase their capacity for the production of heavy plant by at least 50 per cent. The shop itself was practically finished, part of the equipment of machine tools was ready and the remainder well forward, so that they hoped before long to obtain some benefit from their outlay on this extension. Their output in transformers was also a record for the year. In conclusion, the chairman referred to the excellent services rendered by the staff, specially mentioning Mr. Broadhurst, the managing director, and other executive officers.

Mr. B. S. Broadhurst seconded, and the resolution was carried.

A. Reyrolle & Co., Ltd.

The annual meeting was held in Newcastle-on-Tyne on April 7th. Mr. W. Negus, who presided, said that during the past year they had paid off the whole of the debentures, £6,400, which were outstanding at their previous meeting. At the end of 1920 they also owed to the bank an overdraft of £36,300, which had not only been wiped off, but there was a large balance in hand. Stores, stock, and work in progress were represented by £125,700, which was about £100,000 less than the previous year. Part of this reduction was accounted for by the smaller amount of work now in hand, but it also represented the severe reduction which had taken place in the value of all materials during the year. Their cash on short loan or deposit with the bank totalled £91,000. That was a very satisfactory position so far as cash resources were concerned, but of course it indicated the very severe contraction in trade which had taken place, and they would much prefer that the capital was utilised in carrying out work. The profit for the year was £54,826, an increase of £12,626 over 1920. The value of goods sold in 1921 was about 16 per cent. higher than in 1920, and as most of the sales were in respect of orders and contracts booked during 1919 or 1920, when high prices were ruling, the accounts for the year showed a satisfactory increase in profits. As regarded the current year, he was glad to say they were in a fairly satisfactory position, as they still had many orders and contracts which had not been completed. On the other hand, orders for new work were coming in very slowly, and unless there was some very distinct improvement in trade in the near future it was bound to have a serious effect on their profits. Apart from the small volume of work in the market, prices were very low and competition was keen, so keen that there was very little margin of profit. They were fully equipped for the highest class of work, and when an improve- in trade came they looked forward to a share.

Urban Electric Supply Co., Ltd.

Mr. P. D. Tuckett presided at the annual meeting on March 28th. In moving the adoption of the report and accounts the chairman said that in spite of the coal strike and industrial depression there had been a substantial improvement in the results. Had it not been for the set-back experienced by the Cornwall Power Co. and Hawick, the increase would have been some £12,000 larger. The adverse result at Hawick reflected the depression in the tweed trade, upon which the prosperity of the town was largely dependent. Although a gradual improvement was hoped for, the chairman feared that recovery would be slow. Last year's output fell by 40 per cent. The contracting profit had fallen from £4,622 in 1920 to £2,555; but 1920 was an exceptional year, and the fall not unexpected; the amount was not unsatisfactory. While gratified to be able to resume a dividend payment, the directors deplored the necessity for adding still further to the arrears of cumulative dividend; there were now four years' dividends unpaid. This position was due, as he had mentioned at previous meetings, to the refusal of the authorities to permit them to adjust their prices to constantly advancing costs. Mr. Tuckett calculated that the company had lost £150,000 as a result of these restrictions. They had at last, however, been conceded higher rates, and with lower costs it should be possible to resume payment of the full preference dividend in a year's time. Turning to the balance sheet, the chairman pointed out that the outstanding debenture debt had been reduced by £9,000, while the amount due to contractors had been paid off to the extent of £30,000; the latter had been further reduced during the present year. The total of reserves had increased by nearly £38,000. Although the company could rely upon assistance from Edmundson's in any emergency, it was incumbent upon the company to husband its resources to avoid increasing the debt to that firm. Owing partly to reluctance to undertake new business involving capital expenditure, and partly to industrial depression, the additional connections made were the smallest for some years. Referring to the Cornwall Power Co., the speaker said that the closing of the tin mines had resulted in the loss of about 70 per cent. of its business and the outlook remained very discouraging. At the same time the opinion was held in mining circles that there was still plenty of tin to be worked: it was therefore hoped that eventually the position would right itself. Five of their undertakings still remained under the restrictions imposed by the Statutory Undertakings (Temporary Increase of Charges) Act, 1918. As the fate of the present Electricity (Supply) Bill appeared uncertain, the company had taken, by the advice of the Electricity Commissioners, other steps to remove the anomaly. They were anxious to reduce their charges to their customers, but owing to the restrictions under which the company had laboured, it

would ill serve the real interests of consumers if prices were reduced prematurely; the present charges were by no means excessive. The special exemption from the operations of the Corporation Profits Tax, granted to public utility companies, owing to the special circumstances under which they worked, terminated at the end of the present year. The same considerations which secured this exemption still remained, and representations were on this account being made to the Government to permit its continuance; it was hoped that the application would be successful, especially as competing local authorities would still be exempt from taxation. Mr. Crosthwaite seconded the resolution, and after the chairman had stated, in reply to a question, that he did not consider that the funding of arrears of preference dividend would be advantageous to the shareholders, the resolution was carried unamimously. Mr. F. E. Gripper, the retiring director was re-elected.

British L. M. Ericsson Manufacturing Co., Ltd.

The directors report a particularly satisfactory result for the year ended December, 1921. After writing down stocks to present day values and after charging £22,107 for annual depreciation of buildings, plant, &c., £9,977 for income tax, £9,122 for interest on debentures and loans, and £600 for debenture issue expenses (being the balance thereof), the net profit amounts to £68,997, plus £43,897 brought forward, making an available total of £112,894. The preference dividend requires £5,999, and a dividend of 10 per cent. (free of income tax) to the ordinary shareholders, £10,001. There is to be placed to reserve account £30,000, and to special reserve account, to meet future contingencies, £15,000, carrying forward, subject to payment of Corporation Profits Tax, £51,893. The loans included in last year's balance sheet, which amounted to £109,727, have been paid off. The cash position, at the end of 1921, shows a balance in hand of £32,034, and in addition, bills receivable for £26,300 are held. Lieut.-Col. P. W. d'Alton has been appointed a director of the company.

London Electric Wire Co. & Smiths, Ltd.

Sir G. H. Fisher-Smith presided at the annual meeting held in London on April 7th. After referring with regret to the death of Mr. A. L. Don, an original director, who had been connected with the company for the last 29 years, he went through the accounts. He stated that investments held by the company had increased to the extent of £185,430, which addition represented investments in gilt-edged securities, priced at cost or less. The total under this heading was expected to increase rather than decrease in value during 1922. On the liabilities side there was a decrease in sundry creditors of £144,007, and under this heading provision had been made to meet the heavy demands to be made by the Inland Revenue authorities for taxation. The general reserve account was increased by £50,000, because it was felt necessary to take a conservative view of the future, the general reserve account now standing at £150,000. Although the profit for the year showed a slight decrease, the balance available for distribution, after the interim and final dividends on the preference shares and an interim dividend of 1½ per cent. on the ordinary shares had been paid, was higher by £5,619.

There had been a considerable falling off in customers' orders and the good showing was to a great extent due to customers' orders carried forward from 1920 to 1921. It was not easy to forecast the future, but it was hoped that the Government would insist upon rigid economy and reduce taxation, and all must endeavour to remove the existing industrial unrest. These two conditions, being within the country's control, would, if accomplished, improve trade and lessen unemployment. The chairman urged that masters and men should pull together, for without co-operation between them real commercial success was impossible. When the employer and the employed worked together in harmony confidence would be restored and business enterprise resumed. He had no hesitation in saying that with a revival of trade the electrical industry would be one of the first to reap the advantage, so that this company had good reason for hope in the future, being wholly connected with this particular industry and splendidly equipped to take advantage of a trade revival when it came.

Canadian General Electric Co., Ltd.

The annual meeting held at Toronto on March 28th, had before it the report for 1921, which stated that while 1920 was a year of great expansion in both volume of business and in profits for the company, 1921 was one for the whole country of very great shrinkage in the amount of business secured and profits made, and this company was no exception to this general condition. Therefore (says the *Financial News* abstract), until there is a general improvement in trade conditions and greater activity in building operations and other construction work, any substantial increase in the company's volume of business cannot be looked for. The profit and loss statement shows that a profit of $1,707,339 was earned, and after deducting $519,416 for interest paid on borrowed capital and $401,831 for depreciation, the net profit is $706,092; adding $778,672 brought in, there is $1,474,764 to credit of profit and loss. From this $927,088 has been paid in dividends at the rate of 8 per cent. per annum on common stock, and 7 per cent. per annum on preferred stock, leaving $557,726 carried to credit of the account, showing that the directors had to draw on the undivided profits to the extent of $220,946 to provide for the dividends. The cash outlay on plants and equipment during the year amounted to about $1,400,000, and was practically limited to carrying out and completing extensions commenced in 1920, and no new additions are contemplated in the immediate future. The patents and goodwill are carried at the nominal value of $1, but as an indication of their actual value, it is stated that some time ago an arrangement was concluded under which the company granted a licence to the Marconi Wireless Telegraph Co. of Canada, Ltd., to manufacture, use, and sell devices in connection with wireless telegraph and telephone operations, the patents for which are the property of this company and included in the above account. As a consideration, this company has received a considerable portion of the share capital of the Marconi Co. The Marconi Wireless Telegraph Co., of Great Britain, is interested with the Canadian General Electric on an equal share basis in the Canadian company, and as it is expected that the next few years will witness a great development in the use of wireless telegraph and telephone apparatus, the outcome of this transaction should be very satisfactory. A further arrangement was entered into under which this company took a material interest in the Canadian Radio Corporation, Ltd., of Toronto, controlling the Canadian Independent Telephone Co., Ltd. This company is rapidly developing the manufacture and distribution of wired wireless, standard telephone, and automatic telephone apparatus under the Squier and De Forest patents, which it owns for Canada.

Rangoon Electric Tramway and Supply Co.—According to the *Financial Times*, a dividend of Rs. 1 per share, free of tax, to shareholders domiciled in India or Burma on ordinary shares, making Rs. 1½ for the year, is recommended; £30,000 to reserve for renewals; £2,927 for depreciation on sundry assets in Rangoon; £7,333 for Indian income tax; £3,359 for corporation tax; £3,641 for employés' provident fund and bonus; £2,927 for depreciation of sundry assets; £3,224 for loss on exchange and expenses of new issue; £26,305 for repairs, renewals, and maintenance; £12,969 carried forward. It is proposed to increase capital to £800,000 by the creation of 300,000 shares of £1 each.

Eastern Telegraph Co., Ltd.—Owing to unavoidable delays in obtaining the necessary returns from foreign stations and administrations, it will be impossible to issue the audited accounts for the year ended December 31st, 1921, in time to allow of the annual general meeting being held in the month of May, but a meeting will be convened as soon as the full accounts can be submitted. A final dividend for the year 1921, of 2½ per cent., free of income tax, on the ordinary stock, is to be paid, making 10 per cent., free of income tax; also one at the rate of 3½ per cent. per annum, less income tax, on the preference stock for the first quarter of 1922.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—Owing to delays in obtaining the necessary returns from foreign stations and administrations, the accounts for the year ended December 31st, 1921, cannot be ready in time to allow of the annual general meeting being held next month. A final dividend for the year of 2½ per cent., free of income tax, is to be paid, making the total for the year 1921, 10 per cent., free of income tax.

Melton Electric Light Co., Ltd.—Mr. W. J. New presided at the annual meeting, recently held at Melton Mowbray. The report showed a gross profit of £7,166, as against £5,092. The debenture and loan interest absorb £1,007. £1,000 is put aside for repair of accumulators, £2,000 is put to renewal of plant, £1,000 to general reserve, 10 per cent. is the total dividend for the year, and £687 is to be carried forward.

Stock Exchange Notices.—The undermentioned securities have been ordered to be officially quoted:—

British Thomson-Houston Co.—£1,500,000 seven per cent. mortgage debenture stock.

South Metropolitan Electric Light & Power Co.—6,532 seven per cent. cumulative first preference shares of £1 each, fully paid, Nos. 293,469 to 300,000; and 3,634 six per cent. cumulative second preference shares of £1 each, fully paid, Nos. 396,367 to 400,000.

County of London Electric Supply Co., Ltd.—755,780 ordinary shares of £1 each, fully paid (Nos. 1 to 755,780), and 650,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1,500,001 to 2,150,000).

Thames Valley Electric Power Board.—£350,000 6 per cent. debentures of £100 each (guaranteed by the Government of New Zealand) (Nos. 1 to 3,500).

Direct United States Cable Co., Ltd.—A final dividend of 4s. per share, less tax, making a total of 4 per cent. for the year ended March 31st, is announced.

Indo-European Telegraph Co., Ltd.—Final dividend of £1 2s. 6d. per share for 1921, making a total of 7 per cent., free of tax, for the year.

Chiswick Electricity Supply Corporation, Ltd.—According to the *Financier*, the report for 1921 states that the capital expenditure on works at Chiswick and Aberystwyth was £3,893. The revenue for the year was £43,722, against £41,987. After paying sinking fund, premium and trustees' fees, the profits were £17,373, compared with £15,770. Deducting interest on first mortgage debenture stock, the balance to credit of net revenue was £14,029. Dividend, 8 per cent.; to depreciation reserve, £8,000; carrying forward, £3,040.

W. H. Dorman & Co., Ltd.—Reduction of Capital.—In the Chancery Division, on April 4th, Mr. Justice Lawrence heard the petition of W. H. Dorman & Co., Ltd., engineers, of Stafford, and confirmed the reduction of the capital from £700,000 to £437,500, by writing off 15s. per share on each of the issued ordinary shares.

Evered & Co., Ltd.—Meetings of the holders of the "A" and "B" shares of the company are to be held on May 3rd to consider and approve a scheme of arrangement between the company and themselves, as directed by the Court on March 24th.

STOCKS AND SHARES.

Monday Evening.

People who would not look at the War Loan when the price was about 85 are now confident that the quotation will go well over 100, and are backing their fancy, as the saying goes, by the employment of surplus funds in the purchase of the stock at par. There has been an enormous amount of buying during the past few business days, and the robust strength shown by the War Loan is the principal reason for the firmness exhibited by investment securities of all kinds. That people are not rushing indiscriminately after new stocks, however, is shown by the remarkable result of last week's issue of the Whitehall Electric debenture stock and preference shares. The underwriters of the debenture have been left with 75 per cent., while the preference underwriters received 92 per cent. of the 7½ per cent. cumulative shares offered at par. The 6 per cent. debenture stock came out at 87½. The offer for sale was made by the Whitehall Trust, Ltd.

The Whitehall Electric Investments, Ltd., as already announced, has been formed mainly for the purpose of acquiring interests in companies engaged in supplying power and light to cities, towns and industries, in operating tramways and assisting in the development of electrical undertakings generally, in South America and Mexico. The prospectus showed the debenture stock to be tolerably well secured, while the preference shares do not seem to be a bad investment of a rather speculative class. The price of the latter opened at 2s. 9d. discount, and hardened to 2s. 3d. discount; the debenture stock from 2¼ discount rose to 1¼ discount, so that those who did not apply on the prospectus have now an opportunity for getting into the preference at figures more favourable than those of the underwriters, whose commission was sixpence per share.

Electricity supply shares show no diminution of their strength. Further rises have occurred in Brompton ordinary at 7½, Westminsters 7, Metropolitans 4¼, Londons 1 9/16, County of Londons 12. City of London preference regained their dividend at a guinea, and the list as a whole exhibits marked buoyancy.

The firmness has extended to manufacturing shares. Edisons recovered to 4s. 6d., on the expectation that the meeting on Tuesday this week might elicit a speech from the chairman that would afford consolation to shareholders. The first preference, which had been down to 12s. 6d., hardened to 13s. 9d., and the 5 per cent. debenture stock at 63 is a point to the good. English Electrics strengthened to 10s. 3d. Metropolitan-Vickers preference rose to 2¾, and Vickers ordinary at 11s. 9d. are materially better on the week. The company is about to start an air service in connection with the Shell oil concern, for transport to Rangoon. Siemens at 27s. 6d. are half-a-crown up, and the preference at 30s. show a substantial rise. Henley's advanced to 2, Callender's to 37s. 6d. British Insulated are a good market at 39s. Babcock and Wilcox at 3¼ are again half-a-crown higher. The new issues are also better. Jutland Telephone debenture is up to 4¼ premium, and Telephone Manufacturing scrip has risen to 95.

The Eastern Telegraph Co. has announced its usual dividend, making 10 per cent. for the year, and the Eastern Extension followed suit. Both companies, however, state that the accounts will not be here in time to allow of the general meetings being held in May. This delay is the cause of a little curiosity, because it is generally held that companies are getting back to pre-war punctuality in the matter of presenting accounts, &c. Nothing more has been heard in Stock Exchange circles of the rumour, current a little while ago, to the effect that the cable to India is to be duplicated.

Prices in the cable market are better, with rises in Eastern ordinary, Eastern Extensions, Globes, Great Northerns (30s. up), Indo-Europeans and Western Telegraphs. The last-named have advanced 7s. 6d. Anglo-American preferred at 98½ shows a gain of 1½. Marconis hardened to 2 3/16, and United River Plate Telephones at 6½ have more than recovered the slight dulness which overtook the price last week. Telegraph Constructions at 24½ are 10s. higher.

Central London Assented ordinary at 65 is 1 better, and the Underground group is generally firmer, with improvements in Metropolitans, Underground ordinary, and Income Bonds. Districts at 33¼ have shed 10s. after their rise of 5 points last week. The real strength of the market is seen more especially in the prior-charge stocks. New Metropolitan preference was subscribed in the course of a few hours, and a premium of two or three points is expected to be established when dealings begin.

The foreign list is good, with big rises in most of the stocks connected with Mexico. These range from 2 to 5 points, in consequence of the expectation that present negotiations will definitely result in some mutual understanding being reached between the United States and Mexico that will have the effect of permitting formal recognition of the latter by America and this country. British Columbia Electric stocks have spurted, the deferred rising 6 points. Anglo-Argentine Tramways are better; the 5 per cent. debenture stocks gained 3. A number of improvements occurred in various dollar bonds. The rubber market has strengthened owing to an improvement in the price of the produce, and generally speaking, the markets of the Stock Exchange are winding up the week before Easter with a healthy tone and a disposition to follow the rise of the War Loan, which at the time of writing is saleable at 100. In our own price-lists this week there are over forty rises, against a solitary decline.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price April 10, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7½	+ ½	£5 0 0
Charing Cross Ordinary	8	9	6¾	—	7 4 0
do. do. do. 4½ Pref.	4½	4½	3¾	—	6 8 7
Chelsea	6	6	5¾	—	5 9 1
City of London	14	14	35/-	—	8 0 0
do. do. 6 per cent. Pref.	6	6	31/-	+1/-	5 14 2
County of London	8	8	12	+ ½	6 13 4
do. do. 5 per cent. Pref.	5	5	5¾	+ ¼	6 10 0
Kensington Ordinary	9	10	6¾xd	—	8 0 0
London Electric	2½	4	1⅞	— 1/32	7 15 2
do. do. 6 per cent. Pref.	6	6	4¾	+ ¼	6 16 6
Metropolitan	7	7	4¾	+ ¼	7 5 4
do. 4½ per cent. Pref.	4½	4½	3⅝	+ ¼	6 5 2
St. James' and Pall Mall	12	12	7½	—	8 5 6
South London	7	7	6¾xd	—	8 7 0
South Metropolitan Pref.	7	7	5¾	—	6 4 5
Westminster Ordinary	10	10	7	+ ½	7 2 10
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	95½	+1½	6 1 10
do. Def.	1¼	1¼	21½	—	5 2 6
Chile Telephone	6	6	5⅜	—	5 11 7
Cuba Sub. Ord.	7	7	8	—	8 15 0
Eastern Extension	10	10	183	+ ½	5 7 3
Eastern Tel. Ord.	10	10	182½	+2	5 6 1
Globe Tel. and T. Ord.	10	10	18½	+ ½	5 7 3
do. do. Pref.	6	6	10⅞	+ ⅛	5 10 4
Great Northern Tel.	22	24	30½	+1½	7 19 0
Indo-European	10	10	88	+1	*6 11 7
Marconi	25	25	2⅛	+ 1/32	6 17 0
Oriental Telephone Ord.	12	12	2	—	*6 0 0
United R. Plate Tel.	5	5	6¾	+ ¼	*5 15 5
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18⅝	+ ⅛	*5 6 0
Home Rails.					
Central London Ord. Assented	4	4	65	+1	6 1 3
Metropolitan	1½	1½	43	+ ½	5 7 2
do. District	Nil	Nil	33½	— ½	2 19 8
Underground Electric Ordinary	Nil	Nil	2⅛	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	4	2	77½	+1	*5 3 3
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	85	—	7 11 3
do. do. 2nd Pref.	Nil	5½	32	+ ½	7 6 *
do. do. 5 per cent. Deb.	5	5	77½	+3	6 9 3
Brazil Tractions	Nil	Nil	4½	—	Nil
British Columbia Elec. Rly. Pfce.	5	5	66½	+2	7 6 0
do. do. Preferred	5	9½/-	61½	+3	*7 11 6
do. do. Deferred	3	12½/-	61½	+6	*9 11 10
do. do. Deb.	4½	4½	74	+2	5 18 1
Mexico Trams. 5 per cent. Bonds	Nil	Nil	63½	+5	—
do. do. 6 per cent. Bonds	Nil	Nil	3½	+5	Nil
Mexican Light Common	Nil	Nil	19½	+3	Nil
do. Pref.	Nil	Nil	88½	+4	Nil
do. 1st Bonds	Nil	8	70½	+5	7 1 10
Manufacturing Companies.					
Babcock & Wilcox	15	15	3¼	+ ¼	5 2 3
British Aluminium Ord.	10	10	¼	—	—
British Insulated Ord.	15	15	39/-xd	+2/9	7 13 10
Callenders	15	15	1¼	+ ⅛	8 0 0
" 6½ Pref.	6½	6½	1⅛	—	6 7 4
Crompton Ord.	10	10	13/-	—	12 6 8
Edison-Swan	10	—	4/6	+1/-	—
do. do. 5 per cent. Deb.	5	5	63	—	8 1 4
Electric Construction	10	10	20/9	—	9 13 10
English Electric	8	8	10/9	+6d.	15 12 2
do. Pref.	6	6	16/6xd	—	7 7 8
Gen. Elec. Pref.	6½	6½	20/9	—	6 5 4
do. Ord.	10	10	21/-	—	9 10 6
Henley	15	15	2	+ ½	7 10 0
do. 4½ Pref.	4½	4½	4½	—	5 9 1
India-Rubber	10	—	⅛	—	—
Met.-Vickers Pref.	8	8	2¾	+ 1/32	6 14 9
Siemens Ord.	10	10	27/6	+ ½	*7 5 5
Telegraph Con.	98	98	94½	+ ½	*5 17 10

* Dividends paid free of Income Tax.

"GUBBINGS."

By G. E. MOORE.

The word "gubbings" is slang—technical slang it is true, but still slang. Now, regarding slang, I wish to state right away that I am not one of the purists who oppose its use. I consider that a slang-word is no worse than a word from a dead or even modern foreign language, because most people would understand the slang-word and not the latter. And on referring to the dictionary I feel fortified in my belief, for it says that slang is "an expressive kind of speech used by classes of persons among themselves." After all, we need to be *expressive* sometimes. Certainly I am an unblushing supporter of technical slang. (In view of my record I can hardly say otherwise!) There are many words which are much too stiff and distant; and as electrical engineering (to give a familiar instance) has evolved, so have alternatives to formal names and expressions appeared, a kind of intimate *patois* coming into use. Of course at impressive affairs like the reading of papers one expects the proprieties to be observed, but imagine the sensation if a speaker so far forgot himself as to refer to "the com. of our old genny," and to talk airily of "pushing the jolly old juice about"! However, on these historic occasions we must be lenient with posterity and firmly abhor engineering jargon. Away from such functions I think we may be forgiven if we lapse into familiar work-a-day colloquialisms. It may be laziness, it may even be a shaky memory, but one feels much more at ease.

Army inventiveness in the neological line resulted in quite a flood of such expressions as "the doings," "oojah," "carryonski," and the like. These were terms which one applied at will, but naturally the actual object referred to at the moment was known to everybody present. At any rate it was *supposed* to be known. I remember a sad event when this was not so; the proposal was that the "old bat" should be heaved into "the doings," the latter being a particularly fœtid French pond and the "old bat" a set of accumulators which at a critical moment had been a "wash-out" owing to sulphation. I admit that to throw the "old bat" into the stagnant "doings" would be typical of Army extravagance; be that as it may, the Commanding Officer happened to be lingering in the vicinity and somehow or other jumped to the conclusion that he was the "old bat" under discussion.

Now, "gubbings" is to be classed with the terms just mentioned; to be more precise, it is an engineeringism. Before dealing with its use and misuse a little biography will not be out of place. The word was originally introduced to the writer and his colleagues by Mr. Seven-Upside-Down-E, and it is the outstanding example of that gentleman's large and expressive stock of slang. One may well wonder how he came to possess so curious a name—I hasten to explain that it is one of his *incidental* names (unknown as yet at Somerset House), and it was conferred upon him by his fellow technicians. How this came about is really a story in itself. "Our place" had recently undergone one of those trying periods (from which no industrial undertaking is exempt) when a heartbreaking series of petty "disappearances" had taken place. The writer, for instance, was despoiled of a pair of cutting pliers which had become endeared to him by years of faithful service; and our friend with the unusual name was also numbered among the victims. As usual, the brigand did not think of walking-off with a meter, or the box of scrap-iron, or even that confounded rotary with the fearful brush rattle. Of course the culprit was not found—he never is; and, of course, as a result of the various losses everybody was seized with a perfect frenzy of marking his own belongings and such others as had somehow come into his possession. Now, our aforementioned friend's initials are "L. E." Among the stocks of stamps he could find an "E," but no "L." Undismayed, and with true engineer's resource, he used a No. 7 stamp upside-down. Is it any wonder, then, that he automatically became "Mr. Seven Upside-Down-E"? The christening was inevitable! The introducer of the term "gubbings," therefore, was Mr. Seven-Upside-Down-E. I say "introducer," because, rather to my disappointment, I found that he was not the inventor. There are so few real inventors nowadays that it is an honour—a rare honour—to meet one. The author of "gubbings" remains unknown to me. I have, however, traced the word back as far as possible, and the most I can find out about it is that once it had an elevated meaning, an R.A.F. pilot using it to indicate low-lying clouds or "scud." And so eventually and deviously it came to earth, and when I first heard it in use it referred to so material a substance as the filings and dirt which appear from nowhere, and with malice aforethought nestle between the braking-magnet and disk of a meter. "Well," I suppose many readers will say, "I'm hanged if that stuff is worth giving a name to." But a meter-man has a deep and abiding interest in such gubbings; they sometimes

"Directing a Forceful Blast."

are the bane of his existence, for to them it's a ridiculously easy feat to slow-down a meter and even to stop it on low loads. Needless to say, neither the meter-man nor an electricity supply undertaking is at all enamoured of gubbings, but "it's an ill wind that gathers no moss," I have been told, and to many a consumer they could form the unknown benefactor reducing his quarter's bill or even being responsible for quite gratuitous "juice."

Of course, gubbings are often blamed when (not being present) they should be thanked. For meters are like many other fractious things in this world. They behave annoyingly; you take them down; you reassemble—and lo! without any radical change having been effected their behaviour is now exemplary. Or sometimes you may get the converse, when the result is not so pleasant. With meters one rather gets into the habit of directing a forceful blast at the gaps between the braking-magnet and disk as soon as the cover happens to be removed; it may be that no gubbings are present, but still, there is a sort of feeling or instinct that one should do this. That shows the sort of stigma resting

on gubbings. There comes to mind the case of a polyphase power meter which behaved in a most unorthodox way; it ran quite well on one-twentieth load, but stopped on full load. A special brand of gubbings was immediately suspected, but could not be tracked down; the problem even called for deep thought. Quite accidentally it was discovered that the moving system was seriously unbalanced, and this had its effect when torque was at a maximum, the pivot being pulled up to the top of the jewel-cup and the disks impinging on the poles. No gubbings, though!

Since the post-war blight fell upon industry, gubbings have attained unto more importance, for many works, collieries, and so on, require so little power that there is but insignificant metering to be done. This is where gubbings are in their element. It may be that the only load is a couple of lamps in the office and one in the commissionaire's cabin, with an occasional motor running, and if the meter is, say, a heavy-amperage one and gubbings happen to be present, there's small hope of the meter showing much consumption of power. If this sort of thing were not noticed—well, there would soon be appreciable loss of revenue. Hence eternal vigilance on the part of the meter people. It will readily be understood that gubbings have quite a definite connection with the economic situation. When this fact occurred to me I thought that a really imposing and classical article might be written upon gubbings in relation to the industrial depression. I had an idea (a vague and perhaps too-imaginative idea) that one could point the moral very effectively by comparing the wheels of trade to meter-disks—the gubbings, of course, being inflated currencies, international suspicion and disorganisation, the Bolshevistic attitude of No. 123 Branch Society of Stop-Valve Supervisors, and so on and so forth. The remedy would be delightfully simple: Merely blow the gubbings away! But I fear the idea is too lofty, and anyway I am a bit timorous of powerful diatribes camouflaged as technical analogies.

In any case something happened which turned me against the term "gubbings." Interested readers will recollect that it was applied in the first instance to something quite specific. But in the course of time (familiarity breeding contempt) the term was extended, and it appeared that you could have gubbings on the poles of meter elements. Then it began to signify *any* foreign matter which impeded the action of a meter—dirt in the pinion or may be rust on the pivotal spindle-end. Worse was to follow. "Gubbings" began to be applied to such useful articles as Blackley tape, soldering flux, and the like; in short, anything which the speaker's mental lethargy or low, slangy taste permitted. And—crowning horror!—it once referred to an I.E.E. subscription.

Under such circumstances I, for one, will have no share in applying or popularising the term. Now that it can have no definite meaning it is no better than such familiar things as "what-d'ye-call-it" and "the doings." From being a real, specific thing it has degenerated into a shadowy anything. I don't want to have any dealings with so loose a term as "gubbings." It has ceased to be scientific and is simply anathema; and it fills me with just the feeling I had when, after solemnly warning one of the girl assistants to note the current value at a given signal, the helpful creature reported "Five amps, and a bit."

Now, therefore, do I state my abhorrence of the term "gubbings," and hereby regret any support I may have given to its general adoption.

ELECTRO-FARMING.

By R. BORLASE MATTHEWS, M.I.E.E.

[*Abstract of paper read before the* Institution of Electrical Engineers.]

(*Concluded from page* 497.)

Some of the more interesting details of the more important uses of electricity applied to agriculture are given in an appendix to the paper which, coupled with the paper, will indicate that scientific electro-farming is one of the chief factors in furthering the world's progress.

Appendix.

The employment of electric light in place of other illuminants unquestionably adds very greatly to the safety and convenience of work in such places as barns, byres, stables and yards where there is so much hay, straw and other inflammable material. But there are many other incidental advantages.

The author's experience on his own farm has shown that since installing electric light in the cow byres, milk loss due to spilling has practically stopped. In fact, the value of the milk so saved is more than sufficient to pay (at 4d. per kWh) for the energy consumed. Certain animals can be brought to an earlier maturity by carrying on the feeding for a few hours after sunset and also before sunrise, in the winter time in northern climates. Electric lighting is also being used very successfully in poultry laying-houses, with the object of increasing the egg production during the winter months, when eggs fetch the highest prices. Careful investigation seems to indicate that the hens do not lay more eggs per annum, but by the use of electric lighting, and consequently longer hours of feeding, it has been conclusively shown that more eggs are produced at the time they are most in demand. The cost of supplying electric light from 6 a.m. to dawn and from dusk to 9 p.m. is only ¾d. per bird per year.

On account of the deleterious effects encountered in farm buildings, arising chiefly from ammoniacal and acid fumes, the general system of wiring should be similar to that used in chemical factories. For the same reason the fittings should preferably be of the all-porcelain type which can be sealed up to prevent ingress of moisture, &c. While 0.75 foot-candle is suggested for the farm buildings, four or five times this illumination is recommended for the living rooms of the farm house.

Various electrical methods have been employed to obtain sterile milk. However, the question has arisen whether absolutely sterile milk is of advantage to anyone except the trader. The temperature of incubators can be regulated more accurately by the aid of electric heaters than by any other means. The greatest advance in incubator construction is, however, the employment of electric fans for thoroughly circulating the air inside the apparatus. Incubators of the same capacity on ordinary lines would require seven times the floor space and, consequently, much larger buildings.

One regulator and two thermometers are required for a 10,000-egg incubator, as against 74 or more regulators and a similar number of thermometers necessary with the ordinary mammoth incubator. Moreover, the electric fan-operated incubator permits continuous factory-like hatching. On every

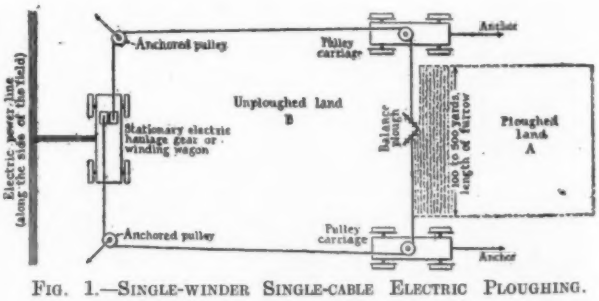


Fig. 1.—Single-winder Single-cable Electric Ploughing.

Tuesday, say, a fresh lot of eggs is put in the incubator and at the same time live chickens are removed from the bottom trays. The percentage of fertile eggs hatched is higher than is obtained in natural or other artificial processes; the author has averaged 83.5 per cent. with a 2,240-egg incubator—the first and only one so far in this country. Above all, the chicks are healthier and stronger.

Eggs incubated in machines of the ordinary type have to be taken out of the apparatus and cooled once or twice every 24 hours, but under the electric fan system the eggs require absolutely no cooling. A 60-egg incubator of the ordinary pattern, but electrically heated, takes 11 kW to hatch out, while a similar apparatus, but containing 250 eggs, consumes 16 kWh, *i.e.*, the larger the incubator the lower the consumption per egg.

The only difference between electric and ordinary heating in hovers and "foster-mothers" is the substitution of a resistance for a lamp. Recently experiments have been made in California with electric heaters placed round the circumference of a fair-sized room, holding 1,000 or more chicks. A large-scale commercial brooder house in this country recently designed by the author comprises 42 compartments, each holding 75 chicks. A hot-water-heated air radiator is placed in the centre of each. These radiators are now being adapted for conversion into electric heaters.

High-pressure electrical treatment is in the experimental stage, and no definite results are available. The general idea is to produce a high-pressure discharge by means of a fine distribution wire, above young chicks and also laying birds, for an hour or so each day, and seems to stimulate the birds. Probably any good effects are due to the purification of the air in the brooder or laying houses, resulting from the production of ozone in the corona discharge. It is also quite possible that it assists the birds to relieve themselves of any pests.

An electric lamp is, of course, ideal for testing eggs, as it is so easily switched on and provides such a powerful source of light.

The Meteorological Office hopes that wireless weather forecasts will be of considerable use to farmers who may have access to a small wireless receiving set. Careful consideration is being given to the matter of issuing the forecasts by wireless telephony.

In the near future, where sufficient water is available, electric pumping will undoubtedly be used on farms for irrigation in seasons of low rainfall. Thus the farmer will have yet another aid in circumventing the weather, and will be able to adjust the supply of water to the needs of the crop. Only by electric pumping is such a scheme, desirable as is in itself, a commercially possible project.

In Holland and other countries very large electric pumping installations are now in operation for the removal of excess water. Windmills have been displaced, because when pumping is required during rainy periods there is usually no wind. An interesting development of irrigational farming is the maintenance of the water level in the fields at definite depths below the surface, in accordance with the nature of the crops, controlled by automatic electric pumps.

Much experimental work in electric ploughing has been carried out, but no entirely satisfactory solution has been reached. Extensive practical work in Germany, Sweden, Italy, and France has sufficiently demonstrated that the results are in favour of electricity as compared with animal, steam, or oil ploughing tackle. The only important competitor of electricity is steam, under conditions where fields are very large, and even then the electric system has many superior advantages. In the case of small fields the electric system is undoubtedly most advantageous on account of its great economy. The systems employed so far may be summarised as belonging to one or other of the following groups:—

(*a*) An electric accumulator plough.
(*b*) An electric motor-operated plough, with a trailing supply cable.
(*c*) An electrically-hauled plough on the Fowler steam system.
(*d*) An electrically-hauled plough on a modified Fowler system with a single winder.
(*e*) An electrically-hauled plough of the Roundabout or Howard steam system.

Table I. shows the position with regard to the systems:—

Table I.

System.	Remarks.
(*a*)	Equipment too heavy; packs the land excessively; cannot be used on soft ground.
(*b*)	Heavy equipment; considerable wear on trailing cable; electric cable winding gear unsatisfactory.
(*c*)	Double-rope haulage; large capital outlay; method successful on large scale; requires wide headlands, trailing distribution electric cables and 80-125 h.p.
(*d*)	A compromise between systems (*c*) and (*e*).
(*e*)	Single-rope haulage; the most practical for ordinary farms; outlay reasonable; requires 30-60 h.p.; anchorage difficulties not nearly so great as with the Howard steam system.

Double-rope haulage is beyond the reach of the average farmer, as he has not sufficient land to justify the outlay. It is, however, well adapted for contract or co-operative work. For this purpose the author has suggested a plant for use in situations where there is no public supply of electricity. It consists of a heavy oil generating set, of Diesel or semi-Diesel type, mounted on a lorry that is intended to be drawn to the point on a main road nearest to the fields to be ploughed, the idea being that such a heavy plant could not be successfully hauled over soft or ploughed land. The electric power is transmitted by a temporary overhead line to the field to be ploughed. A somewhat similar scheme has been put into practice in France and Germany, but substituting for the lorry power station a portable transformer house, which is drawn up close to the nearest h.p. transmission line.

The single-rope method of ploughing, fig. 1, though old from a steam-tackle point of view, is comparatively new as an electrical method. The tackle comprises a single electric motor with two haulage-rope drums, either of which can be driven by the motor, as desired by the operator, while the other pulley pays out rope. The haulage rope, by the aid of suitable pulleys, follows round the sides of the field to be ploughed. At two corners anchored angle pulleys are provided. At the other two corners are stationed pulleys mounted upon carriages. An anchor rope is taken from each of these carriages to the side of the field. When the rope is pulled by the haulage set the pulley carriages are drawn along to the extent permitted by the slack in their anchor ropes. The balance plough is attached to the haulage rope between the two pulley carriages. The method of ploughing is to haul the plough from one pulley carriage to the other. The balance plough is then turned over ready for the next set of furrows. Before starting the new run, the anchor rope of the further pulley carriage is slackened out, thus permitting this carriage to advance a distance equivalent to the width of the new set of furrows. The plough is then drawn over to this further pulley carriage, and so on. Thus, as the ploughing proceeds, the pulley carriages gradually approach the hauling set.

A large haulage set will plough from 19 to 20 acres per day (on an average) as compared with nearly 1 acre with horses. Electric ploughing sets can be used on much steeper ground than steam sets. Normally from 30 to 36 kWh are consumed per acre, ploughing three 12-in. furrows at once on average ground. The nature of the ground and weather conditions markedly affect the consumption.

The problem of electric ploughing is not merely a matter of solving electrical difficulties. It involves also a careful consideration of the design of the implements to be employed. The scientific principles of the design of even such features as ploughshares do not seem to have been carefully investigated.

Regarding the electrical operation of harvesting machinery, the increased cost of labour and the greater value of time, nowadays call for faster cutting and also the possibility of cutting any kind of crop in any sort of condition by machinery.

The use of an electric motor drive for the binder (as developed by the author) meets these requirements, and tests on binders show that the draft is lessened. As the drive is not obtained from the bull wheel the machine can be used in certain sections of the farm where wet ground has hitherto made the operation of the binder very difficult. The use of the electric motor also permits the cutting of heavy grain in a proper workmanlike way when the binder has to be drawn at comparatively low speeds, *e.g.*, when turning corners and the like. This is accomplished, owing to the fact that the knives or sections run at a constant speed throughout. It is this fact, coupled with the possibility of the independent control of the speed of the knives, that makes it practicable to cut heavy tangled crops that have been blown by the winds. With the electric motor drive crops can be cut at a rate about one-third faster than the normal. Similar beneficial results are to be obtained when mowing machines are electrically equipped for cutting grass for hay.

In America combined harvesting and threshing machines are successfully employed. This system saves considerable time and circumvents bad weather conditions, which so often spoil a crop after cutting. In Great Britain this practice cannot be followed at present, owing to the necessity for curing the grain, which is not subjected to such powerful sunshine whilst growing. The author is, however, of the opinion that it can be accomplished, if proper drying and curing electric-fan arrangements are provided at the farm buildings. A combined harvester and thresher is essentially a machine to be electrically driven.

The object of electro-culture is to increase the harvest yield by stimulating plant growth. It is very difficult to determine what increase can be obtained by electrical means, because so many natural factors, whose exact influence is still but imperfectly understood, also affect the result. On the whole an electrically-treated crop may be reckoned upon to produce at least 10 per cent. more grain, accompanied with a proportionate increase in the quantity of straw. The cost of electricity is negligible, so that the problem has little interest for the electricity supply undertaking. Vegetable growth is accelerated by currents of the order of 0.3×10^{-9} ampere, but plants are injured by currents of 10×10^{-9} ampere. The chief question, therefore, is what amount of capital is necessary to attain this increase in the crops. The cost of stringing the wires is not at all important, for 4 or 5 lb. of fine wire (29 S.W.G.) is all that is required per acre, plus the heavier insulator-borne cable supports around the field. The serious factor is the cost of the transforming and rectifying apparatus.

It is estimated that the capital cost of a 100-acre equipment would be about £4 per acre. By deduction from the experiments which have so far been carried out, the most suitable

arrangement for a commercial farm is to provide an alternating-current supply; a 100,000-volt oil-cooled transformer; and a mechanical rectifier driven by a small synchronous motor. The overhead network should be 15 ft. above the ground. It would probably be necessary to operate such a plant only for about an hour in the morning and again in the evening, during the spring and early summer months. The transformer would be preferably switched on and off by a time-switch. A Lodge or similar valve would probably give a more efficient discharge than a mechanical rectifier, but on large-scale work these valves do not appear to be so practicable. In the course of time it seems quite likely that the transformer may be superseded by a motor-driven influence machine. Owing to the low power factor of these installations it is necessary, before accepting the readings of any instruments, to see that due corrections have been made. However, there are considerable differences of opinion as to methods.

An interesting feature that seems to be allied with electrical treatment, is the possibility of the destruction of insect pests, largely brought about by the fact that, in the presence of a high-pressure discharge, the antennæ, wings, legs, &c., of the insects tend to rise and so become uncontrollable, causing the insects to fall helplessly to the ground.

Various theories have been put forward to account for the effects produced, *e.g.*, that the discharge produces manurial or plant-feeding effects. However, the quantity of electricity used is so small that only an infinitesimal amount of manure or its equivalent could possibly be produced, even under the most favourable conditions. In fact, the best results from electrification are always obtained from the land which is richest in nitrogen. Hence the author's deduction is that it is entirely a physical, stimulative effect. Whatever the cause the fact remains that better results are obtained with electrically-treated crops. Also the cost of carrying out the electrical treatment (apart from considerations of the capital required for the installation) is nominal.

The employment of short heat waves from luminous electric heater lamps has been experimented upon on a small scale, and it would seem that the power consumption necessary is likely to be very great.

A drying plant is a useful form of rural industry that can be economically added to many electrically-equipped farms. Many farm products in seasons of plenty are wasted, simply because it does not pay to market them at the time. It does not pay to employ electricity as the heating medium for drying purposes. However, rubbish can be burned to provide the necessary heat, the fan being electrically driven. The author has successfully dried wet green grass by the aid of an electrically-driven fan alone, without auxiliary heating other than that produced by the natural heating of the rick.

Normally, given suitable weather conditions, there is no better way of making hay than by the aid of the sun. However, in bad weather, artificial hay-making becomes a commercial proposition.

Artificially-dried hay looks better, has a better aroma than naturally-dried hay, and its food or nutritive value is greater. Incidentally, when artificial drying is adopted, the process can be made continuous instead of necessitating the concentration of a large amount of labour for a relatively short period. If the hay-drying apparatus be combined with auxiliary arrangements for drying fruit, vegetables, hops, etc., it becomes a paying proposition for any farm, even when it is not used for hay-drying in favourable sunny seasons.

The ensilage method of conserving green fodder for the winter has lately come into extended use. The latest development is electrical silage, of which there are already nearly 100 examples in Germany. It is claimed that by this method the fodder is better preserved, as objectionable bacterial action is arrested before it has time to do any damage. Each silo has an earthed electrode fixed at the bottom, and a live electrode is placed on top of the freshly-cut green-stuff, when the silo is filled. Up to 10 kVA is required for a silo of about 20 ft. (6 m.) in height and 14 ft. (4.25 m.) in diameter, and the time required is from 24 to 48 hours. Ten tons of fodder require between 130 and 200 kWh.

The commercial test of any improved method is the financial result, and this can be shown accurately only by the aid of proper account books. An ordinary farm cannot afford large book-keepers' salaries, and accordingly the author devised a semi-automatic system for keeping and analysing his own accounts, as it was very essential to keep accurate accounts on a farm where new methods were being applied. This "Auto-Countancy" system would, although originated for farmers, also be a boon to all small professional and business offices. It is a double-entry method, which does not depart in any feature from the accepted principles of modern efficient book-keeping. The system is preferably carried out with the aid of an electrically-operated book-keeping machine, adapted by the author from the now familiar cash register of the shop-keeper (the ordinary cash register is, of course, merely a single-entry device). These machines are costly, but they can be purchased for a sum not exceeding the salary of a good clerk for a year.

Not only are proper ledger accounts kept by this method, but also the analysis of the costs of any department of the farm are rendered available, whilst, at the same time, the services of skilled clerks are dispensed with. Every account, whether "out" or "in," is entered on slips of paper in quadruplicate. These slips are then inserted in a mechanical file or pasted into a set of loose-leaf books, if so preferred, in accordance with their classifications. This placing of slips substitutes the usual posting of separate entries by the pen of a clerk, and mistakes due to copying are avoided. Further, no particular skill or knowledge of book-keeping is required, while a trial balance of the whole business can be read off at any moment. This is due to the fact that all accounts are kept simultaneously. Hence, account-keeping by electricity has much to commend it to the farmer. A suitable electric machine would consume about 2 kWh per annum; the size of motor required is only $\frac{1}{32}$ h.p.

Discussion in London.

When the discussion was resumed on April 6th, the President said that on the last occasion there was a tendency on the part of the speakers to say that electricity was of little value on a farm except for light work, and he was sure they would all look forward to hearing that electricity could be used on a large scale on a farm. It was of interest and importance to find that engineers were taking an interest in farming; the farmers would learn something from the engineer as a consequence, and the engineers would learn still more from the farmers. An institute had been set up for the purpose of conducting scientific research upon farming methods, and it had issued careful instructions as to how cows should be milked and what should be done to keep the milk clean.

Mr. Borlase Matthews then showed a further series of lantern slides illustrating applications of electricity on the farm on the same lines as those exhibited when he read the paper originally.

Mr. H. W. Richardson said that on the last occasion he found it a little difficult to realise that he was at a meeting of electrical engineers, so pessimistic was the tone of the speakers as to the possibility of the uses of electricity on the farm, except as regarded electro-culture. He could not help feeling that a brighter note might have been struck in the remarks Mr. Atkinson made last time. Most of the difficulties referred to had been overcome in Germany, America, Holland, and Denmark, and surely they were capable of overcoming them in this country. The position with regard to electricity on the farm at the present moment was very like that with regard to heating and cooking some years ago, when many people thought there was no future for it, but there could be no doubt as to the value of electricity for cooking and heating now, and he believed there was a still greater future for it. If they did not consider the matter seriously they would eventually find they were losing business through not preparing early enough. There were 418,000 farms and small holdings in the country, and if they took 60 per cent. of them as likely to use electricity, that was 250,000. If each used 2 kW for five hours a day—a low figure—that meant a consumption of considerably over one thousand million units per annum. That was more than the total number of units that were generated and supplied in the whole country in 1910, so that it would be a valuable addition to the load. The Institution ought to appoint a committee for the purpose of collecting data with regard to the uses of electricity on the farm and to see how the whole thing could be stimulated by taking it up in an energetic manner. As to transmission, he was not sure that they should reckon on having a three-phase supply all over the country in the future. It had been said that there was some prospect of the single-phase railway system being developed to a considerable extent, and, as this would form one means by which supply to farms would be given, it was a point to be considered. He had understood that the fat content of milk was improved by hand milking owing to the stripping action of the hands in milking. Milking would be rather a useful load, as it was done early in the morning and late in the evening, and the load was considerably greater in the summer than in the winter. Electric fans in the cowshed assisted cleanliness. In Hereford a load factor of from 20 to 25 per cent. had been obtained. The manufacturers needed to pay a lot of attention to the switchgear, and it seemed to him that the push-button variety would be largely required. There was great scope for improving the efficiency of poultry farming by the use of electricity, but the British farmer rather looked upon poultry as a side line. There would be an advantage in having two smaller motors rather than one large one for ploughing, as the smaller motors could be used for other purposes than ploughing. As for electro-culture, Mr. Britton, of Chester, had increased his vegetable crop by something like 80 or 90 per cent., although it was admitted that that result was rather of a freak character. Nevertheless, it did suggest that large increases in yields could be obtained by electrical stimulation methods. He himself had rather thought the effect of electro-culture was due to an action of the current on the ground, and it might be worth while making the experiment of treating the ground before sowing the crop and not during growth. A farmer working 150 acres was making a great deal more than £112 a year, as mentioned by Mr. Atkinson, but at the same time he believed a great deal of good could be done by co-operative methods with regard to machinery. There were co-operative societies all over Germany, and if that policy were adopted in England, it would assist materially in the development of the uses of electricity.

Mr. W. R. Cooper said one of the main difficulties was the

farmer himself. It was all a matter of £ s. d. from the farmer's point of view, and the author had not gone into that side of the question sufficiently, remembering that farm labour was comparatively cheap. He was surprised to see a quotation from the report of the Electroculture Committee—of which body he was a member—as he understood that those reports had not yet been published.

Dr. F. J. Crowley said that anyone who had investigated the use of electricity in farming on the Continent would be optimistic. At the same time, when one considered the small amount of attention that had been given by electrical manufacturers in this country to the perfecting of plant for that purpose, one could, to a certain extent, understand the small progress that had been made in England. It was necessary completely to redesign plant used on the Continent for use in this country. There had been tremendous development in the use of mechanical plant on farms in a comparatively short time, and there were enormous possibilities for the use of electricity to drive that plant; experience on the Continent and in America had shown that wherever a supply of electricity existed, electricity could meet the need for power. The manner in which electricity was being employed on farms in southern Germany was truly remarkable. Dr. Crowley showed a large number of lantern slides depicting various uses of electricity on Continental farms, and also types of apparatus. As for ploughing, there was a big difference between the type of plant used in France and in Germany; in the latter, very heavy equipment was used, whilst in France they were endeavouring to evolve a light anchorage wagon in connection with electric ploughing. It was probable that an intermediate weight would suit the conditions in this country. He did not agree with the author's advocacy of the roundabout system of electric ploughing; he could not see why a system that had failed with steam should be more suitable with electricity. The single or double haulage system would probably be best. The method of dealing with ploughing and other apparatus must be co-operative.

Mr. H. A. Carney said that in Germany the most extended use of electricity was on the small farms, and there was a greater use for electricity for simpler purposes, such as lighting and power, than in the more complicated ones, such as electroculture. In connection with poultry and pig rearing, a great deal could be accomplished by increasing the hours of light and shortening the time to bring the animals to maturity, and the financial return to the farmer could be considerably increased in that way. The small-holder stood in greatest need of the services of electricity, because such a man could not afford to employ much labour and had to do the bulk of the work himself. The petrol engine would not give him the same service because of the need for some mechanical knowledge to keep it in good working order and, moreover, the attention which an oil engine needed occupied time which would be more profitably expended on farming. On the figures given in the paper, the consumption would vary from 26,000 units per annum upwards, so that from the supply point of view the smaller the farm the more profitable would the supply become, because it was in the case of small farms that the greatest use would need to be made of electricity. In some cases a considerable amount of pole line might be necessary to give the supply, but in New Zealand the supply authorities considered it perfectly good business to supply a milking machine load only, knowing that as the farmer became accustomed to the use of electricity, he would extend its applications; 25 per cent. of the milking in New Zealand was now done electrically, and the load was increasing at the rate of 16 per cent. per annum. Another method adopted in New Zealand was co-operation between neighbouring small holders; a number of farmers would associate and get a supply at a certain point, which would be given at a bulk price, and then they made their own arrangements for getting the supply to their farms. They supplied the poles, and the labour and the necessary technical assistance was given by the supply authority; thus the overhead distribution lines were constructed at a minimum cost.

Mr. Hyde pleaded for a little more enthusiasm in this branch of the industry. His experience of electrified farms in Germany and Sweden was that the more electricity was used, the more it was wanted. One 5-h.p. and one 15-h.p. motor could do all the work on a small farm, the small machine being on a barrow and the larger one on a covered truck. He agreed that electric ploughing did not seem to have reached a very important stage at present. As to supply, the difficulty was that they had not much overhead equipment to give it. It would be a commercial proposition to build a power station to supply a number of small holdings, but that involved pioneer work for farmers which they probably would not like.

Mr. C. J. Hopkins said that the paper described farms as they might hope them to be in the future, whereas Mr. Atkinson had described them as they were to-day; if a supply were more easily obtainable than was the case now, many farmers would take it. He was not altogether with the author in his recommendation of individual motors for every machine, on the score of cost, and it would be better to have a portable motor and a belt, which could be applied to various machines. Milking machines had not been the success in this country that they should have been. The farmer objected to complicated machinery on the score of the expense of repairs, and he knew of a case in which a farmer left a tractor to fall to pieces in the field rather than have it repaired, owing to the cost. The farmer decided his operations for the day early in the morning, and wireless weather reports during the day would not help him very much.

Mr. E. K. Scott suggested the possibility of the farmer making his own nitric fertiliser by the arc process, when electricity became generally available, because the arc furnace was simple to handle. They ought to take the broad view and remember that suggestions made at meetings might enormously benefit people in the Colonies and elsewhere. Farms in this country were small, but a farm in New Zealand was of 139,000 acres, and in those cases the possibility of making nitric fertiliser on the farm by the arc process should not be overlooked. In Illinois a colliery belonging to the Standard Oil Co., of Indiana, had put up an electrical plant which was five times as large as the colliery itself wanted, but it was realised that the country around was agricultural, and developments were being prepared for in advance. There would be a world-wide market for nitric fertiliser, quite apart from its manufacture on a small scale on individual farms. The process could be worked on both a large and a small commercial scale.

Mr. R. Borlase Matthews, replying to the discussion, said that since the war, Continental motor manufacturers had turned out more than half their output for farm purposes, which amounted to many hundreds of thousands of kilowatts per annum. Over 600,000 h.p. of motors were now used on farms, and he did not think the practicability of using electricity on farms could be questioned. This country was the chief centre for the distribution of agricultural machinery for the world, even if some of the appliances were of American origin; therefore, they should be in the van as regarded electro-farming. It was difficult to say what was the smallest farm that could be electrically equipped. On the Continent he had seen a 24-acre farm equipped electrically, and no farm there was considered too small to benefit from the use of electricity. The oil engine was not a good substitute for electricity. He had experienced that to his cost, and knew something about it. Assuming an outlay of £20 for an electric motor, 10 per cent., or £2 per annum, or 1¼d. per day, would cover the interest and depreciation. That was equivalent to a man's time for 48 hours, and was much less than the time he would lose in looking after the oil engine for a year. In fact, £2 was less than the cost of a man's time spent in starting up the oil engine when it was in good order. Last year each of his horses cost £147, including a portion of the driver's time. Electricity at 2s. per unit would be cheaper than horses for such work as it would be applicable to. On the small farm where electric power was available one horse was enough. He himself kept three horses on a 600-acre farm. The principle to work upon was intensified farming to increase the output and the profits, and great savings could be effected by the judicious application of electricity. The Howard steam-ploughing system had been a failure, but when applied to electric ploughing it was a most practicable system when they were using from 12 to 60 h.p. The most successful system at the moment for that power was the roundabout system, although possibly the eventual system would not be that one. He was trying a new motor which looked as if it would work out to about one-third the cost of existing motors, and in that case the individual drive would justify itself. Finally, Mr. Matthews offered to show his farm to anyone interested.

The National Association of Supervising Electricians.—About 20 members of the N.A.S.E. availed themselves of the invitation of the Electrical Apparatus Co., Ltd., to inspect that company's Vauxhall Works, on Saturday last. An idea of the wide range of the company's work was gathered from the numerous examples set out in the shops. Major Amberton and Messrs. Evans and Walton acted as guides, and carefully explained everything and carried out many demonstrations on starters and controllers. They were fully occupied in answering the searching questions put to them. Special interest was shown in a printing press controller, recently completed by the firm. Upon the conclusion of the tour of the shop, tea was served in the drawing office, and after this Mr. Windibank expressed the thanks of the Association for the company's hospitality and courtesy. He hoped that both would derive profit from the visit. In replying, Major Amberton acknowledged the usefulness of many suggestions made by the visitors, and said that most of them would undoubtedly be adopted .

U.S.A. Electric Vehicle Market.—The Electric Automobile Show opened at New York on April 3rd, and the general opinion is that the show will be the most comprehensive of its kind ever held in New York City.

The Steinmetz Electric Motor Car Corporation has placed on the market a ¾-ton delivery truck, designed by Mr. C. P. Steinmetz, of the General Electric Co., selling at 2,700 dollars, f.o.b. Baltimore. The weight of this truck is 4,450 lb., radius of operation 50 miles, average speed 20 miles, wheelbase 114 in., pneumatic tires 33 in. by 5 in. The monthly meetings sponsored by the Automobile Bureau of the New York Edison Co. are proving very popular; subjects of interest to the trade are discussed.—*Reuter's Trade Service* (New York).

THE LIGHTING OF PUBLIC BUILDINGS.

A paper on the above subject was read by Messrs. E. H. Rayner, J. W. T. Walsh, and H. Buckley, of the National Physical Laboratory, at the meeting of the Illuminating Engineering Society, on March 28th, the chair being taken by Sir Joseph Petavel, director of the laboratory.

The discussion was arranged jointly with the Royal Institute of British Architects.

The paper was devoted mainly to experiments arising out of a request received from H.M. Office of Works for information which would assist in drawing up a specification for lighting installations at the new building of the Ministry of Pensions at Acton. Semi-indirect lighting, with a general illumination of four foot-candles, was decided upon, and the results of the experiments were assembled by the authors in a series of sixteen diagrams, which were discussed in detail. A summary of results shows that the average illumination attained varied from 2.9 to 4.7 foot-candles, the consumption from 0.38 to 0.65 watt per sq. ft. and the coefficient of utilisation (*i.e.*, the percentage of the total flux of light falling upon the working plane) from 43 to 63 per cent. A feature of interest was the limit set on the brightness of lighting units which in the various installations fell within the limits of 0.6 and 2.5 c.p. per sq. in., representing quite a moderate brilliancy. The data should prove useful for future reference in view of the variety of semi-indirect fittings experimented with, some of the ordinary open type, others with over-reflectors.

Another section of the paper was devoted to some experiments in the design of skylights used in picture galleries, new proposals for which were submitted by Sir Frank Baines, of the Office of Works. The chief aim of the new design was to avoid the troublesome reflections of relatively bright objects in the glass of pictures. A final section of the paper contained an account of a special building for experiments on illumination which is being erected in the grounds of the National Physical Laboratory. It is hoped that the building will be very serviceable in enabling resultant daylight illumination to be determined with greater precision when a building is in course of design.

Following the presentation of the paper, Capt. J. W. Liberty, public lighting inspector to the City of London, showed a number of lantern slides illustrating methods of lighting adopted in decorative interiors. The photographs were taken by Mr. J. S. Dow, exclusively by the artificial light available. The first views referred to various rooms at the Guildhall, a pleasing installation being that in the historic Crypt, where simple diffusing glass panes are used to soften the light from gasfilled lamps. Several charming effects produced in the new Marylebone Town Hall, notably some examples by concealed lights in domes, were next shown. The lighting of a committee room (indirect cornice lighting) and of the council chamber (crystal chandeliers enclosing gasfilled lamps and supplemented by electric candles) excited some comment in view of the very dark walls, panelled in walnut, which occasion difficulties from the standpoint of illumination. A contrast in method is afforded by the main office at the new Port of London Authority's building, where the surroundings are of a very light tint, and the lighting is effected by gasfilled lamps of an aggregate of 20,000 c.p. massed in the vast central dome. Another interesting example of modern methods is to be found in the Middlesex Sessions Hall, where semi-indirect lighting is generally employed with excellent effect. Through the courtesy of Mr. Charles A. Baker, electrical engineer to the L.C.C., some particulars of the illumination provided in the various rooms were given. The method adopted in the assembly hall, where the illumination is derived exclusively from bracket lights in diffusing globes, appears to give very pleasing results, and the same applies to the decorative semi-indirect fitting used in the domes in some of the courts. Capt. Liberty also referred to the new London County Council Hall, on the Embankment, which, like the Port of London Authority's building, is still being completed. A feature thereof is the immense length of some of the corridors. Capt. Liberty stated that it was hoped, when the arrangements had reached a more advanced stage, to give fuller particulars of these two buildings.

Another interesting example of spectacular lighting was shown by Mr. Cunnington; namely, the emergency floodlighting of the entrance to Waterloo Station, recently opened by the Queen. The lighting was necessarily effected by units placed quite near to the face of the building, and there was therefore some difficulty in avoiding inconvenient shadows. But considering that this was essentially an emergency lighting installation the effect was quite striking. A fact commented upon in the discussion was the undoubted rise in the standard of illumination in public buildings since the Society commenced its work in 1909. The conditions of lighting in modern buildings are now very much better than a few years ago.

At the conclusion of the discussion, the chairman announced that the next meeting, to be held at the end of April, would be devoted to a discussion on the use of light in hospitals, at which the co-operation of the medical profession would be specially invited.

CYC-ARC ELECTRIC WELDING.

Discussion at Leeds.

At a meeting of the members of the North Midland Centre of the Institution of Electrical Engineers, on February 14th, Mr. Martin read Messrs. Steel and Martin's paper on the above process of electric welding, an abstract of which appeared in our issue of December 9th, 1921. Before concluding his paper Mr. Martin expressed his thanks to Mr. Hefford, the Leeds city electricity engineer, for the arrangements which his department had made to give them a supply of electricity in order to demonstrate the possibilities and features of their apparatus. They were able because of this to make larger welds in the lecture room than they had been able to do anywhere else in the provinces. The paper was illustrated with many lantern slides, and after the discussion demonstrations were made.

The Chairman (Mr. Burnand) in opening the discussion, said he had been impressed by the short time taken to weld a light tube (0.2 of a second), but there was a system of welding even quicker than that, which was used for welding light things, such as spectacle frames. That was done in a thousandth of a second. He did not think it was realised how quick the discharge from a condenser was; the explosion of gunpowder was a very leisurely thing compared with the rate of discharge from a condenser. Another method was described by Mr. D. F. Miner, of the American Westinghouse Co., probably towards the end of 1920. Mr. Miner struck an arc just as Messrs. Steel and Martin did, and dried it up, but the particular feature was that he utilised a reactance. He stored electro-magnetic energy in a sort of big core, which was nearly closed. He charged it up comparatively slowly, and it was discharged in a fraction of a second. That piece of apparatus took the place of the flywheel motor-generator which Messrs. Steel and Martin utilised, and gave a very heavy discharge for a fraction of a second without taking any very great current from the supply. An oscillogram taken during a weld between copper and steel rods ⅜ in. in diameter indicated a peak of current of 2,600 amperes, an arc of 30 volts, a maximum power of 60 kW, energy of 0.00077 kW-hour, and the welding time as 0.0094 second. That corresponded fairly closely to some of Messrs. Steel and Martin's figures, but was somewhat quicker. The apparatus bore a close resemblance to the authors', but differed in detail.

Mr. Hill (Bradford) remarked that there appeared to be considerable use for such welding as the authors had explained in general engineering, perhaps more so than in electrical engineering.

Mr. Balmforth thought that if the surfaces had to be cleaned it would, perhaps, detract from the process rather than if surfaces could be simply welded together without cleansing.

Mr. Hall (Hollinwood, Lancashire) drew attention to another welding process which was developed nineteen years ago by Mr. Ferranti, and which had been used for a number of years quite successfully. In that case the attempt was to weld steel plates on to broken disks and bars, in which they had to have accuracy of setting as well as strength. They developed the resistance method of welding by adding to it the automatic features that Mr. Martin had mentioned. They had also found that the time when the current was passing varied up to six seconds. In some of the plates welded they used a section which was practically half a square inch in the large cases. Such welding as that would take six seconds, but to make the weld possible they had to treat the surface before welding. In the case of a turbine disk the smaller plates were put on at the rate of six a minute, the limit being not the energy consumed, but the work the men had to do to bring the material to and from the job. That was carried on on a large scale at Messrs. Vickers's works in Sheffield. There they started welding steel in the first place and found no trouble with it. Afterwards they tried bronze and several gunmetals.

Mr. Martin, in replying to the discussion, said that with regard to the Westinghouse method of arc welding the chairman had not made it clear whether they were using automatic timing in any form. The main unsatisfactory feature was the unusual size and weight of the storage coils. There were many other disadvantages which would be serious in developing a method like that commercially. The American Westinghouse Co. would have difficulty in welding such variations as the Martin and Steel method could do, such extremes as welding a steel pin on to a heavy armour plate, on to a tube, or a thin plate. They had been asked about the welding of stellite two or three times. Mr. Martin thought that they would weld it quite easily, though they had not done so yet. They could weld with unclean surfaces, but they could naturally weld better with clean surfaces. It was more serious with the small welds where they had not the heat and had not the time to remove the explosive effects of grease; if grease was about gases were generated, and tended to blow the arc on one side. Rust was an oxide of iron with a high melting point; if they got enough oxide it melted, and upon placing the stud in the molten plate the oxide was squeezed out and did not interfere.

The suggestion that there were possibilities of using the

Cyc-arc process for blading turbines he regarded as rather visionary at the present time, but he saw no reason why it should not be developed. Why was the resistance method not developed if satisfactory results had been obtained from it for a number of years? It seemed rather curious that improvements were not made so that they could have kept up with the modern turbine's requirements.

Mr. Hall (Hollinwood) observed that the resistance method of welding was developed in connection with special welding, high temperatures, &c. It was dropped by the people who had control of the patent; the patents ran out, and then there was no object in spending more money as there was little hope of reaping a reward. He had been associated with the method since 1902.

Mr. Jones, in moving a vote of thanks to Mr. Martin, said he seemed to be most successful when the metals were dissimilar. It looked as if the metals when they came together seemed to be more homogeneous; the structure of the metal appeared to have altered. That might have something to do with the fact that the welded portion was stronger than the other portion.

LEGAL.

Postmaster-General *v.* Herbert E. Brooks.

Proceedings were taken by the Postmaster-General in the Railway and Canals Commissioners' Court on April 6th by way of a new trial, because it was said that after a county court judgment, imposing rents of 5s., 10s., 15s., and £1 a year each for electric telegraph poles, instead of "the usual shilling a year," other landowners had sent in asking for 10s. each for poles on their land, and, since there were nearly a million poles on private property in this country, such demands would create a revolution in and be the ruin of an important public service. It was the first time such a matter had been brought before the Railway and Canals Commissioners' Court under the extended jurisdiction given by the Telegraph Construction Act of 1916.

The action was brought for a new trial by the Postmaster-General because of the fixation of rent of six telegraph poles on land of Mr. H. E. Brooks, J.P., C.A., of Stafford Lodge, near Grays, Essex. For three other poles Mr. Justice J. D. Crawford, at the Romford County Court, apparently said there should be no charge, under a judgment of Mr. Justice Lush, because those poles were upon a road. The Railways and Canals Commissioners Court consisted of Mr. Justice Lush, Mr. Tindal Atkinson, K.C., and Sir Lewis Coward, K.C.

Mr. Harold Murphy, for the Postmaster-General, explained that he thought Mr. Brooks's main defence (Mr. Brooks appeared in person) was that, having given up his right to the telephone, owing to increased charges, he deemed himself entitled to exact from the Postmaster-General a much heavier rental than was paid by the National Telephone Co. They paid 1s.

Mr. Justice Lush: But Mr. Brooks had the advantage of free calls in those days.

Mr. Murphy said the Postmaster-General contended that the rates he should pay should depend on present damages and there were no damages whatever to Mr. Brooks.

Mr. Justice Lush: So he is to be paid nothing? You are in occupation of his land. You cannot put up poles on somebody else's land and say you ought not to have any acknowledgment from the user.

Mr. Murphy: I am given a statutory right to place poles on the land on coming to you if he fails to give consent. What you have to consider is whether such conditions as he seeks to impose are contrary to public interest. If there is no detriment or loss of amenity the imposition of any pecuniary payment would be contrary to public interest, and the imposition of a heavy rental would be ruinous to a public service.

Mr. Justice Lush: It would be contrary to public interest that you should pay him nothing. I dare say you would like to pay him nothing.

Mr. Murphy complained that the county court judge's award worked out at 60s. for six poles. There were 818,000 poles on private property, and the average payment was 1s. 4d.; 30 per cent. were free; 95 per cent. were less than 1s; more was paid for telephone standards with stays on the top of buildings and in private gardens, as was equitable. The rent proposed now would be a revolution of the whole system, and on its precedent landowners were coming in with demands for 10s. a pole. That was the serious aspect of the case.

Giving evidence for the Postmaster-General, Mr. Charles Jarrold Eve, of Messrs. Thurgood, Martin & Eve, auctioneers and valuers, said there were nine heads of damage under which he usually assessed damage, and in Mr. Brooks's case he could find no damage under any of them. The poles took nothing from the plough. They were in a wood; they hurt no grass, growing crops, fences or hedges; there was no risk of telegraph men leaving gates open for cattle to stray, there were no gates; there was no game to be disturbed and no cover; no hedge to plash; no spoliation of commercial value; no pruning of ornamental trees for the wires; hay carts could pass under the wires, but there were no cart tracks; driven partridges would have to surmount a higher wood on the other side, and as to unsightliness there was no house near to see the poles. The only development value of the property was in minerals and forestry. If Mr. Brooks was going to build, quarry, or make an avenue, he could give notice to the Postmaster-General to remove the poles.

Mr. Justice Lush: For a small avenue or path I am convinced the poles would not be removed.

Mr. Eve said he himself had never charged more than a shilling a pole and he had charged as little as a shilling for twenty.

Mr. Brooks contended that there was present damage and that he should receive payment in respect of interest in the land and its amenities. He was, he said, director of a cement company, and this chalk land would eventually be worked for cement. He had been in negotiation with his colleagues for the purchase of this property. When he gave the Postmaster-General notice to move the poles, three weeks passed, he was presented with a polite bludgeon—he was told, in effect, "we will not get out, and we are going to use our compulsory power and we give you notice accordingly." Such a threat of litigation did not attract a purchaser. Nobody wanted to buy a lawsuit along with land. He wanted to sell the estate as a whole, but if a purchaser shied at the telegraph poles, 11 acres would be cut off from the property on the other side of the road and he would be left with those 11 acres hung up in the air, £2,000 or £3,000 worse off than if he had not sold it at all. Nobody would buy 11 acres for building. Ten shillings a pole was not adequate compensation for putting this fear in the heart of a purchaser. If the Postmaster-General was presented with a notice to remove on account of quarrying, he might be expected to be just as obstructive and litigious as now and he was only carrying on a trading department. Mr. Brooks suggested that it was only the common knowledge of landowners of the Postmaster-General's legal resources, who compelled them, under this duress, to accept a shilling.

Mr. J. Sinnott, member of the Institution of Electrical Engineers and engineer to the Post Office engineering department, put in returns of consents to the Post Office erection of poles.

Mr. Brooks observed that at the present moment the Postmaster-General was contending with the Chancellor of the Exchequer as to what should be done with the anticipated profits of his undertaking for the year just beginning. As manager for the State of a trading concern, the Postmaster-General should pay a reasonable rental for the facilities he enjoyed at the expense of the private individual.

Mr. Justice Lush said the situation was an interesting one, and it was the first of its kind that the Court had had since the Telegraph Construction Act of 1916. There was the question whether a capitalised sum should not be paid instead of rent. He understood Mr. Eve had mentioned a period of 16 or 20 years for capitalisation.

Mr. Murphy replied that he said nothing against the principle of capitalisation, but in Mr. Brooks's case the assessment should be small.

Mr. Justice Lush said the Court desired to look into the matter, and, as that was the first case of its kind, would reserve its judgment. Judgment would have to be delivered in the next law term.

Childs *v.* Greenberg.

At Marylebone County Court, last week, Henry Edward Childs, an electrician, of Notting Hill, sued Philip Greenberg, a tailor, also of Notting Hill, for £49 10s., the cost of goods sold and work done.

Plaintiff's case was that he carried out certain wiring at defendant's house for lighting purposes, which he estimated at £21, but subsequently reduced to £20. Defendant was to have four lighting points; there was also an agreement to install wiring for heating purposes, to cost £14. Plaintiff completed the work on November 14th last and defendant paid him £10 on account. The house was connected with the local electric supply system, as to which defendant made no complaint. Witness installed the wiring in steel tubes, which was the ordinary way of doing such work. He agreed to put the steel tubing down the walls, but not to "chase" it in the walls. He had heard nothing of not having done the work in accordance with the requirements of the local electrical supply company.

An expert gave evidence that plaintiff carried out the work properly, and that there was no risk of danger owing to the tubing not being "chased" or put below the boards of the floors.

Defendant, in his evidence, said his complaint was that the work had not been carried out according to contract. Plaintiff promised to put the tubing in the walls and ceilings, so that it would not show; otherwise it was to be "chased" so as to be invisible.

Judge Scully said that he would not say that the manner in which plaintiff put in the tubing was unsafe but, in his opinion, it was not according to contract. He gave judgment for plaintiff for £35 5s., the amount paid into Court with costs up to the time of payment in. The judge added that the sum was quite sufficient.

Commercial Traveller's Notice.

In the Mayor's and City of London Court, last week, a commercial traveller named Moscow sued Burstein Isaacs & Co., Ltd., City merchants, for £90 damages for wrongful dismissal. Plaintiff was a commercial traveller at £7 a week and commission, and after working for three months he was dismissed with a week's notice. He claimed that there was a universal custom that commercial travellers were entitled to three months' notice, and made his claim accordingly. The defendants said the plaintiff was engaged for three months on trial, but that, in any event, he was only entitled to a week's notice, which was given him, and that travellers were not entitled to three months' notice. Judge Jackson held that the plaintiff was not engaged on trial, and that commercial travellers in the City—he cared not what trade they belonged to—could not be dismissed on a week's notice simply because they were paid their salary weekly. In his view, if there was not a universal custom, he held that a reasonable notice for a commercial traveller was three months, and therefore he gave judgment for the plaintiff for £84 and costs, stating that he would facilitate an appeal if the defendants so desired in order that the matter might be settled once and for all.

British Thomson-Houston Co., Ltd., *v.* Empire Electric Lamp Co.

In the Chancery Division, on April 7th, Mr. Justice Lawrence granted to the plaintiffs an injunction until judgment—or further order—restraining the Empire Electric Lamp Co., of Shepherd's Bush, from infringing their letters patent for improvements in leading-in wires in incandescent electric lamps. The defendants did not appear.

REVIEWS.

Fifty Years of Electricity; the Memoirs of an Electrical Engineer. By J. A. Fleming, D.Sc., F.R.S. Pp. xi+371; figs. 21, 16 plates. London: Wireless Press, Ltd. Price 30s. net.

The fifty years embrace the period from 1870 to 1920, but in an introductory chapter the author goes further back, sketching briefly the discoveries of workers in the field of electricity and magnetism since Volta, and in considerable detail the development of telegraphy since Cooke and Wheatstone up to the year 1870. The book is not intended only for the professional engineer, but also (and perhaps more so) for the person whom the author characterises as the "intelligent general reader." In the very first pages he invites this person to consider what the position of mankind would be if iron were not a magnetic material. The professional man need not be told what that would imply; he knows what we owe to Oersted's discovery and Faraday's researches, but a layman could not be expected to realise this. Therefore the author tells him. Electric trains and tramways could not function because the dynamo could never have been invented. Even the service on steam lines would be slow and dangerous for want of electric signalling. No electric lighting, heating, cooking and ventilation; no transmission of power, no motor cars using magnetos for ignition; no telephones, and, in fact, paralysis of social life as we know it now. To bring home to the lay mind the importance of electrical engineering he draws a picture of what would be the result if after arduous researches of scientific committees it were discovered how iron could be made susceptible to magnetisation. It would be an intense relief from social disaster, and this shows the layman what benefits the electrical engineer has conferred upon the human race.

The author next draws a comparison between the politician and the electrical engineer. Naturally the former comes off second best, although politicians are apt to think that their services are essential to the community. As a matter of historic fact, they have been rather detrimental, as is shown by the Electric Lighting Act of 1882 and the political tinkering which went on for some subsequent years until the Act had been cast into some tolerable form free from the worst trammels which in the early years throttled the industry. It is this kind of reasoning which the author puts forth to justify his book. To quote his own words: "It seemed, therefore, possible that some slight service might be rendered to the general reader by giving a brief account in popular but not inaccurate language, drawn to some extent from the personal experience of the writer." In a later chapter the author returns to the charge against the politician, and quotes with approval Tyndal's statement that it would be a wholesome and natural test to make admission to the House of Commons contingent on a knowledge of the principles of natural philosophy. In the same chapter there are some other suggestions by the author himself; these will be mentioned at the end of this review.

Turning now to the subject matter of the book, professional men in all branches of electrical engineering will find something to interest them in every chapter, but not to the same degree, or rather, not in the same detail. It is quite obvious that the vast field cannot be covered in the 350 pages of text, but in the selection of the parts which are accorded more detailed treatment the author shows a preference for kinematic rather than dynamic engineering. Thus he describes in great detail with all the various levers, springs, pawls, stops, gears, and mechanism generally (all well illustrated by diagrams and plates) a large variety of telegraphs, including the Wheatstone automatic, its puncher, the typewriter perforator of Gell and Creed, differential relays, duplex and multiplex working, and the various successors of the Hughes printing telegraph, which has been treated in detail in the introductory chapter, because invented before 1870. The mass of technical information in Chapter I should satisfy the most exacting telegraphic engineer. We find here not only the instruments themselves, but accessory apparatus and the alphabets used by different inventors. A list of names must here suffice, such as Baudot, Edison, Murray, S. G. Brown, Keurtley, Axel Ortling, Muirhead, &c.

Next the author takes us to submarine telegraphy, and here he is not so diffuse, and rightly so, because the romance connected with Atlantic cables has been told by many writers, and comparatively recently in Thompson's *Life of Kelvin*. Still, the author gives us sufficient material to be able to appreciate the scientific foresight, pluck, and skill of the men who were in that enterprise, whilst charitably refraining from any comments on the ill-fated "thunder pump" which has been the cause of so much financial loss.

The next 28 pages of this chapter are devoted to telephony, not an undue allowance for so great a subject, especially as the text not only deals with technicalities, but also with various patent litigations and the famous case of the Attorney-General *v.* the Edison Telephone Co. This leaves but small space for purely technical matters, which, however, is utilised to the best advantage. Even such recondite subjects as loaded lines, phantom circuits, exchanges, both hand-worked and automatic (of which type we learn there are 20 in use at the present time in England) are mentioned and explained, whilst the basic fact how articulate speech is reproduced by the effect of changes in the strength of an electric current is clearly explained by diagrams and oscillograph records.

In Chapter II, covering, in the space of 40 pages, dynamos, alternators, transformers and motors, the author deals with these important matters with disappointing brevity. After explaining the magnetisation characteristic the distortion of the field by armature current, he deals with the Brush and Thomson-Houston arc lighting machines, multipolar d.c. machines, the Ferranti alternator, the transformer, the modern three-phase alternator, and the parallel working of alternators. Here there is a curious slip. On p. 42 we are told that if one machine lags behind the other by 90 deg. it will be converted into a motor and be driven by the other machine. Why exactly 90 deg.? Surely a much smaller phase difference suffices, whilst a difference of 90 deg. will bring the machines perilously near to breaking step. We also get a short account of the compensated a.c. series commutator motor and the induction motor, as developed by Ferraris, Tesla, and Dolivo-Dobrowolsky. Considering that nearly all the power used in industry is derived from a.c. machinery, both the expert and the intelligent general reader might reasonably look for a somewhat fuller treatment.

To make up for this we find in Chapter III a very full account, both historical and technical, of electric lamps. After showing the regulating mechanisms of arc lamps and the construction of the earlier incandescent lamps, the author takes us straight away to the modern metallic-filament lamps, and explains the process of obtaining a ductile tungsten wire; he shows plates of lamps, fittings, switches, conduits, fusible plugs, house distributing boards, &c. Photometry is not omitted, and on page 160 we are introduced to the "Edison effect," the basic principle of wireless telephony, which is further treated in a subsequent chapter.

The domestic use of electricity other than lighting is given in Chapter IV, which also contains a good deal of information on the important matter of electric furnaces for industrial purposes, such as the manufacture of carborundum and aluminium, the refining of steel, the production of graphitic carbon, the fixation of nitrogen by the Birkeland-Eyde process, and even the production of pig iron, but here the author tells us that the use of electricity is commercially impossible unless the energy can be obtained at a farthing per kWh. Some interesting figures given by the author may be quoted. Aluminium made before the electric furnace came into use was considered a rare metal. The world's production was only three tons a year, and the price £2 16s. per lb. In 1906 the world production had risen to 12,000 tons, and the price had fallen to 1s. 10d. per lb. Since the war, production and price have considerably increased.

In Chapter V we come to electricity supply stations, storage batteries, railways, and the transmission of power. The intelligent general reader would have been interested to learn something about the big electricity schemes which have been maturing within the last few years, and which involve the control of the supply to large districts by electricity boards, the erection of super power stations, the unification of pressure and frequency, and the linking-up of electricity works all over the country. On these matters the author is unfortunately silent. The history of the first Niagara undertaking is given in some detail, and we learn that the original company and the three which came into existence later draw no less than 800,000 h.p. from the falls. Various important works in Switzerland are also described, including the Beznau-Rhinefelden, Engelberg-Lucerne, Kander-Berne, and a Thury station

supplying power from St. Maurice to Lausanne. The author next describes some English works, more especially the Greenwich, Neasden and Lots Road stations which supply power to the London tramways and the "Underground" lines; he then gives a short historical review of the development of main-line electrification. He expresses no opinion as to the merits of rival systems (d.c., and single- and three-phase a.c.), but one can hardly agree with him when, on page 264, he says that a large amount of railway traction work has been done in Switzerland and Italy with three-phase current and three-phase induction motors. As regards Italy, this is correct, but in Switzerland there are not many examples, and with the exception of the Simplon, no important lines are worked on this system, whilst the electrification of the Gothard line has been made by single-phase with commutator motors, which have proved so successful on the Loetschberg line.

Chapter VI is called "Electric Theory and Measurements." One would expect such a subject to be taken at the beginning of the book so as to give the general reader some sort of basis for what follows. Apart from some elementary text-book matter, such as Oersted's discovery and Faraday's method of showing lines of force by iron filings, there is a detailed account of the potentiometer and an explanation of displacement currents, after which we are introduced to Hertzian waves, the coherer, Röntgen tubes, electrons, speculations as to the ether and the theory of relativity, all, of course, in the briefest outline. Wireless telegraphy and telephony receive, in the next chapter, more ample treatment. As might be expected from the author of "The Principles of Electric Wave Telegraphy," this chapter is altogether admirable. The writer takes us from the first experimental work of Marconi in 1895 to the demonstration at the B.A. meeting in Dover, when wireless messages passed between Dover and Boulogne, and shows how Marconi succeeded by gradual development of his system to send, in December, 1901, with a 25-h.p. plant, signals from Cornwall to Newfoundland. Then follow accounts and explanations of further improvements, by which atmospherics were reduced, the range increased, and the system made absolutely reliable. The author then explains the next great step, which was the discovery of how undamped waves can be produced, and he describes several methods (Duddell and Poulsen arcs, dynamic machines such as the Alexanderson, Latour, Goldschmidt, and Marconi's timed spark), and comes finally to his own invention of the Fleming valve and its use as an amplifier. This leads to wireless telephony, with which he concludes the chapter.

All this is well worth careful reading, as is also the last chapter headed "Conclusion." Here the author strikes the same note as in the beginning of the book, namely, an insistence upon the benefit the world has derived from the labour of the electrical engineer, coupled with an appeal to the State to not only refrain from hindering development, but actually to assist it by promoting scientific research. As regards private research establishments, he contrasts our backwardness with the great work done by American firms and pre-war German firms, but private laboratories expected to yield immediate results in definite branches of industry are not enough. He pleads for general scientific research even if the utilisation of discoveries is not immediately in view. Hence scientists of recognised ability, by means of State grants, should be set free to pursue their investigations without having to rely on industrial employment for their livelihood, or, if at a university, be required to teach any but a small number of highly-gifted students.—Gisbert Kapp.

A Practical Treatise on Three-phase Induction Motors. By Leonard E. Wood. Pp. iv+130; figs. 72. London: The Electrical Review, Ltd. Price 6s. 6d. net.

This little book is intended for the guidance of those responsible for the installation, maintenance, and repair of three-phase induction motors. The author is clearly a practical man who has gained most of his knowledge in the hard school of experience, and, as such, he is well qualified to undertake the task of writing an essentially practical book of this kind. The construction of the induction motor is described in a clear and common-sense way that must be a boon to those practical men in charge of motors who wish to know the whys and wherefores without undergoing the ordeal of a regular technical training. The method of winding three-phase stators and rotors is explained in simple language and by the aid of clear diagrams. Considerable space is devoted to describing the several methods of starting squirrel-cage and slip-ring induction motors, and diagrams are given showing the wiring connections between the motor, the starter and the supply mains. Many useful hints are given with regard to tracing faults and carrying out repairs. The book is well bound, well printed, and profusely illustrated.

At times the author displays the defects of his merits in not always being exactly scientifically correct, although he is always clear in his meaning. The object of this little book, however, is not to teach science, but to give practical men a good understanding of the motors in their charge, and, as such, we have nothing but praise for it. The number of men engaged upon the manufacture, maintenance, and repair of induction motors who would benefit by reading this book is very great, and it is to be regretted that the present high cost of publishing made it impossible to produce the book to sell for less than 6s. 6d. net.

Liquid and Gaseous Fuels. By Vivian B. Lewes, F.I.C., F.C.S. Revised by J. B. C. Kershaw, F.I.C. Pp. xiv+353; figs. 59. Second Edition. London: Constable and Co., 1921. Price 12s. 6d. net.

In the early days of liquid fuel it was pointed out by W. H. Booth in his "Liquid Fuel and Its Combustion," that liquid fuel could never be anything but a special fuel, to be used to cope economically with the crest of a peak load whose endurance or breadth of base was out of all proportion to its vertical height on a diagram of current consumption.

These views are endorsed in the book before us, and are fully recognised by oil fuel supply companies. It was stated twenty years ago by Booth that the annual oil production of the world was only some five per cent. of the coal production. A very recent writer put it at 10 per cent. In the book before us the ratio of coal to oil is put at about one to twenty, and of the one of oil only one-third is available as fuel. With all the strenuous efforts to find fresh sources of oil it seems difficult to keep pace with the rate of exhaustion of the present still-flowing wells. The book before us is decidedly on the side of the pessimists, and indeed looks to the somewhat speedy combustion of the last ton of coal or gallon of oil, and points out in a final chapter how the world may soon be driven to find its winter warmth in the sunbeams of last month rather than in the age-long stored light and heat of the sun in the coal and oil now so rapidly coming to an end.

The editor of the present edition has introduced matter to bring the book up to date, much of such matter being culled from Lewes's own lectures and writings made subsequent to the issue of the first edition.

The latter few pages of Chapter VII are, if carefully read and pondered over, a veritable encyclopedia of the science of combustion, for the reader is brought face to face with the important factor of temperature and the evil effect of exposure of flame to cold bodies, such as, for example, water-cooled boiler plates. The question of temperature is usually neglected. The waste gas from the blast furnace comes in for very few lines. This is to be regretted. Thwaite, to whose efforts the world's recognition of this great power agent is due, died in poverty. He was never fairly recognised in this country, but his ideas were promptly seized by Germany, and this was the last brick which put the German iron industry in the next line to that of the United States, and indirectly encouraged Germany to go to war.

Electrical Transmission of Energy. By W. M. Thornton, D.Sc. Pp. xi+116; 49 figs. London: Sir I. Pitman and Son. Price 2s. 6d. net.

This book consists of brief statements of scientific facts concerning the transmission of electrical energy. These facts are reviewed in the light of the electronic theory, and there is practically no purely empirical matter in the volume.

The very wide range of subjects dealt with may be judged from the following, which were specially interesting to the reviewer:—

1. A summary of the properties of the other end of electrons with notes on the nature and shape of electrons.
2. Faraday's law of electromagnetic induction from the electronic standpoint.
3. The theory of dielectric strength of materials.
4. Dielectric hysteresis.
5. Electric waves and impulses.
6. Breaking of electric circuits.

All these subjects must appeal to all electrical supply engineers, even from the most materialistic standpoint, while their scientific interest is evident.

The book is by no means one which can be read at a sitting, but it should be readily mastered by anyone with a good grounding of electricity and mathematics in the course of a few weeks.

The author states that the subject matter was originally given as a series of informal lectures, and many readers will, like the reviewer, envy those who were fortunate enough to attend them.

The book is well printed and bound, and only one error (6.36^{-18} at the top of p. 24 should read 6.36×10^{18}) was noticed by the reviewer.

There is a short bibliography of works on modern electrical theory for those who wish to pursue the subject further.

Wages in the Electricity Supply Industry.—Sir William Mackenzie, K.C., sat as an arbitrator appointed by the Minister of Labour at the City Hall, Cardiff, on April 4th, to investigate a claim by the employers' side of the South Wales and Monmouthshire Joint Industrial Council for the Electricity Supply Industry for a reduction in the wages of skilled and semi-skilled men by 6s. a week, and those of unskilled men by 4s. Mr. Moxon (chairman of the Newport Corporation Electricity Committee) conducted the case on behalf of the employers, and among others present was Mr. W. A. Chamen (of the South Wales Power Distribution Co.), and Mr. C. G. Morley New (the Cardiff electrical engineer). Mr. J. L. Davis and Mr. F. Quick represented the employés. The arbitrator reserved his decision.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 28b, High Holborn, London, W.C. 1.

8,597. "Loaded transmission lines." Western Electric Co., Ltd. March 24th. (United States, June 4th, 1921.)
8,598. "Telephone systems." L. Polinkowsky and Western Electric Co., Ltd. March 24th.
8,600. "Fuse-carriers and connections therefor." W. J. Markham. March 24th.
8,608. "High-tension transformers." E. Haefely et Cie. Akt. Ges. March 24th. (Switzerland, July 28th, 1921.)
8,619. "Arrangement for maintaining constant the speed of direct-current electrical machines." J. Bethenod. March 24th. (France, March 25th, 1921.)
8,620. "System for registering telephone calls." P. Lavender. March 24th.
8,624. "High-frequency electric generators." Newton Bros. (Derby), Ltd., and F. Newton. March 24th.
8,633. "Method of magnifying intermittent electric impulses." H. St. G. Anson. March 24th.
8,639. "Electrically-propelled coke trucks." Electricars, Ltd., and J. P. Kemp. March 24th.
8,646. "Electric insulators." W. H. Eccles. March 25th.
8,670. "Electric switches, &c." F. D. Denner and L. J. Lepine. March 25th.
8,671. "Electric distribution or fuse boards, &c." H. B. Prentice. March 25th.
8,673. "System of winding electric coils for inductances for radio-telegraphy, &c." T. A. W. Robinson. March 25th.
8,687. "Electric time transmitters." C. G. Hayward. March 25th.
8,710. "Electric signalling systems for railways, &c." Westinghouse Brake & Saxby Signal Co., Ltd. (Union Switch & Signal Co.). March 25th.
8,721. "Regulation on long-distance transmission lines." A. M. Taylor. March 27th.
8,763. "Device for transmitting electrical impulses by means of balls, disks, &c." J. H. Broome. March 27th.
8,765. "Devices for receiving and transmitting electric impulses." J. H. Broome. March 27th.
8,769. "Sparking plug." F. Jones. March 27th.
8,773. "Overload circuit breakers." F. Krupp Akt. Ges. March 27th. (Germany, April 25th, 1921.)
8,785. "Counting and indicating device for telephone calls, &c." W. Morell Akt. Ges. March 27th. (Germany, October 17th, 1921.)
8,787. "Systems of electrical distribution." Metropolitan-Vickers Electrical Co., Ltd. March 27th. (United States, June 3rd, 1921.)
8,793. "Telephone systems." Siemens & Halske Akt. Ges. March 27th. (Germany, March 31st, 1921.)
8,807. "Microphones." E. D. Young. March 27th.
8,808. "Stand for Röntgen tubes, &c." Reiniger, Gebbert & Schall Akt. Ges. March 27th. (Germany, March 26th, 1921.)
8,811. "Multi-filament electric lamps and switches therefor." S. G. Barker. March 27th.
8,813. "Vibration indicators." British Thomson-Houston Co., Ltd. (General Electric Co.). March 27th.
8,822. "Short circuiting electrical devices." C. F. Killar. March 27th.
8,824. "Manufacture of silver and electro-plated goods." E. S. Jones. March 28th.
8,825. "Systems of reception for modulated wave telegraphy and telephony." E. Y. Robinson. March 28th.
8,830. "Sparking electrode for sparking plugs." H. S. Hutchison. March 28th.
8,842. "Electric furnaces." E. Marchesi. March 28th.
8,848. "Reversing gears operated by electro-magnetically actuated friction clutches." H. T. Boothroyd. March 28th.
8,869. "Head lamps for motor vehicles." J. C. Morrison. March 28th.
8,880. "Self-indicating sparking plug." P. W. Corless. March 28th.
8,881. "Electric switches." W. S. Kelly. March 28th.
8,887. "Overload circuit breakers." F. Krupp Akt. Ges. March 28th. (Germany, June 20th, 1921.)
8,890. "Electric overload protective systems." F. Krupp Akt. Ges. March 28th. (Germany, May 26th, 1921.)
8,899. "Indicating mechanism for printing telegraphs." E. E. Kleinschmidt. March 28th.
8,904. "Braking systems for dynamo-electric machines." British Thomson-Houston Co., Ltd. (Compagnie Francaise Thomson-Houston). March 28th.
8,906. "Locking device for securing electric lamps to holders." M. J. Railing and C. W. Saunders. March 28th.
8,909. "Terminal banks." Coventry Automatic Telephones, Ltd. (A. H. Adams). March 28th.
8,910. "Machine switching telephone systems." Coventry Automatic Telephones, Ltd. (R. C. Arter). March 28th.
8,914. "Telephone exchange systems." Wesetrn Electric Co., Ltd. (Western Electric Co., Inc.). March 28th.
8,915. "Electric motor for gramophones, &c." C. A. Youldon. March 28th.
8,917. "Electric signalling system for railways." G. C. Reed. March 28th.
8,941. "Method of equalising pairs of self-induction coils for loading pupinised four-wire telephone lines." Felten & Guilleaume Carlswerk Akt. Ges. March 28th. (Germany, October 22nd, 1921.)
8,943. "Telephone systems." Siemens & Halske Akt. Ges. March 28th. (Germany, April 7th, 1921.)
8,952. "Ignition circuit makers for internal combustion liquid piston prime movers." S. P. Christie. March 29th.
8,953. "Three electrode thermionic valves or vacuum tubes." L. J. Rich. March 29th. (United States, April 2nd, 1921.)
8,959. "Flow meters." V. R. Nicholson. March 29th.
8,965. "Electrically-driven lathes." V. R. Nicholson. March 29th.
8,966. "Accumulators or storage batteries." J. Timms. March 29th.
8,973. "Devices for wireless telegraphy, &c." R. W. Robson. March 29th.
8,979. "Head lamps of road vehicles." S. Coxon, P. Ross and F. M. Soulsby. March 29th.
9,005. "Multiple-way switch for signs, &c." H. Cooper and B. Radley. March 29th.
9,009. "Electrical illuminating machine." G. A. Walsh and L. T. Walsh. March 29th.
9,021. "Time switches." A. H. Brackensey and Franco-British Electrical Co., Ltd. March 29th.
9,023. "Metal-filament incandescent lamps." Cosmos Lamp Works, Ltd., and J. A. Orange. March 29th.
9,032. "Electric converting apparatus." J. E. Calverley and W. E. Highfield. March 29th.
9,034. "Hand tools for connecting telephone, &c., wires to insulators." P. T. Nielson. March 29th.
9,063. "Electricity meters of the electrolytic type." P. C. Rushen (Siemens Schuckertwerke). March 29th.
9,083. "Electric spark gap apparatus." P. Davey and H. Kennedy & Co. March 29th.
9,084. "Telephone mufflers." L. S. Scher. March 29th. (United States, April 21st, 1921.)
9,089. "Thermostat controls." Spencer Thermostat Co. March 29th. (United States, April 8th, 1921.)
9,109. "Electric lamps for cycles, &c." A. J. Riley. March 30th.
9,114. "Electric egg tester." F. L. Heppell. March 30th.
9,122. "Electric water heaters." G. W. Close and Imperial Engineering Co., and W. T. Pearson. March 30th.
9,125. "Electric ignition apparatus." E. H. Cardwell. March 30th.
9,133. "Electrolier chains." W. J. Beaver. March 30th.
9,143. "Intercommunication telephone systems." V. Hutchinson. March 30th.
9,154. "Electric heaters or stoves." C. E. Garratt. March 30th.
9,159. "Electric conduit fittings." R. E. Barton and Bartons & Sons, Ltd. March 30th.
9,178. "Multiplex printing telegraphy and radio telegraphy." E. Peruzzi and S. Preti. March 30th. (Italy, March 31st, 1921.)
9,179. "Electric switches." F. J. Holtom and M. J. Railing and T. Taylor. March 30th.
9,180. "Speed control of electric motors." A. E. Angold and M. J. Railing. March 30th.
9,210. "Mounting electrodes or electric discharge points in hulls of ships." James' Antifouling Appliances, Ltd., and H. Neville and J. B. Wilkie. March 30th.
9,219. "Telephonic apparatus." British Thomson-Houston Co., Ltd., and K. F. Kingwell. March 30th.
9,231. "Electric installations." Soc. La Metallurgique Electrique. March 30th. (France, December 28th, 1921.)
9,238. "Collapsible boxes or cartons for electric lamps." A. Aviss. March 31st.
9,252. "Connector or coupling for electric cables." J. Greenhalgh. March 31st.
9,330. "Methods of indicating and recording load on weighing machines and dynamometers." H. S. Hele-Shaw. March 31st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

23,249. "Automatic electric direction indicator for motor vehicles." T. W. Bennett. March 23rd, 1921. (176,814.)
26,473. "Rotating field magnet for high-speed electric machines." M. Gruber. September 15th, 1919. (151,030.)
28,116. "Electro-scopic apparatus." F. A. Johnsen and K. Rahbek. February 15th, 1919. (151,997.)
28,203. "Electric lamp or similar brackets." F. Marpole and V. C. Bond. October 5th, 1920. (176,825.)
28,714. "Method of cable signalling." F. E. Pernot and L. J. Rich. October 11th, 1920. (176,827.)
29,012. "Diaphragms and the like for telephone transmitters." R. L. Murray and Telephone Manufacturing Co. (1920), Ltd. October 13th, 1920. (176,831.)
31,317. "Electrical wiring systems." H. V. McLoughlin. November 5th, 1920. (176,839.)
31,618. "Magneto-electric machines." R. Bosch Akt. Ges. April 22nd, 1920. (162,264.)
34,276. "Electric heaters." C. A. Xardell. April 13th, 1920. (161,327.)
34,504. "Electric cord conductors." C. E. Carter. December 7th, 1920. (176,859.)
35,303. "Liquid electric controllers and/or starters for electric motors." A. West & Co., Ltd., and A. West. December 15th, 1920. (176,887.)
35,316. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). December 15th, 1920. (176,889.)
35,336. "Wireless transmitting stations." H. J. Round. December 15th, 1920. (176,892.)
35,337. "Aerial systems employed in wireless telegraphy and telephony." C. S. Franklin. December 15th, 1920. (Addition to 155,330.) (176,893.)
35,464. "Thermionic valves for wireless telegraphy and telephony." L. G. Preston, B. Hodgson, and T. E. Goldup. December 16th, 1920. (176,898.)
35,630. "Electric resistance material and methods of manufacturing the same." British Thomson-Houston Co., Ltd. (General Electric Co.). December 18th, 1920. (176,905.)
35,938. "Selector switches for automatic telephone system." Western Electric Co., Ltd. (Western Electric Co., Inc.) December 22nd, 1920. (176,911.)

1921.

461. "Electric relays." N. W. McLachlan. January 5th, 1921. (176,932.)
1,228. "Self-induction coil couples for loading duplex telephone systems operating on the Pupin principle." Felten & Guilleaume Carlswerke Akt. Ges. January 2nd, 1920. (157,316.)
1,396. "Machine for providing cables with a loop or eye and for wrapping the cables." O. E. Edstrom. January 10th, 1921. (176,943.)
1,421. "Alternating-current electric motors." British Thomson-Houston Co. Ltd. September 11th, 1914. (157,730.)
2,270. "Cable clamp." R. Zollner. January 17th, 1921. (176,962.)
3,055. "Electro-magnetic switches or cut-outs." A. H. Railing, C. C. Garrard and W. Wilson. January 25th, 1921. (176,978.)
3,209. "Impulse transmitters." Automatic Telephone Manufacturing Co., Ltd. February 13th, 1920. (158,826.)
3,579. "Battery cell covers." R. M. Jones. January 29th, 1921. (176,988.)
4,195. "Electrically-heated cooking ranges." Metropolitan-Vickers Electrical Co., Ltd. March 1st, 1920. (159,872.)
5,235. "Electric light pendants." H. M. Burr, J. E. Barber and W. F. Merry. February 15th, 1921. (Cognate application 16,400/21.) (177,008.)
5,348. "Electrical regulators." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). February 16th, 1921. (177,009.)
5,627. "Electro-mechanical pocket lamp." Soc. Blot Garnier & Chevalier. July 24th, 1920. (167,141.)
5,674. "Charging boards for electric accumulators." C. E. P. Gabriel. February 19th, 1921. (177,016.)
6,158. "Alternating electric current circuits comprising condensers." E. W. Dorey. February 23rd, 1921. (177,024.)
6,381. "Electric lamps for use on motor vehicles." C. L. I. Manufacturing Co., Ltd., and E. A. Watson. February 25th, 1921. (177,026.)
7,007. "Head lights for automobiles and the like." P. V. Mertzinger. March 8th, 1920. (159,835.)
7,293. "Electrical relay devices." Metropolitan-Vickers Electric Co., Ltd. May 4th, 1920. (163,027.)
7,449. "Truck type electric switchboards," Johnson & Phillips, Ltd., and H. Bailey. March 8th, 1921. (177,044.)
8,096. "Apparatus for production of X-rays." E. E. Greville and F. W. Read. March 15th, 1921. (177,055.)
8,981. "Starting devices for electric motors." British Thomson-Houston Co., Ltd., and J. Sugden. March 23rd, 1921. (177,060.)
12,187. "Electric terminal couplings." W. J. Polyblank. April 28th, 1921. (177,082.)
14,790. "Change-over apparatus for operating electrically-propelled vehicles with different voltages." Akt. Ges. Brown, Boveri et Cie. May 28th, 1920. (163,998.)
15,324. "Apparatus for propelling convevor trucks with electric drive." Siemens Schuckertwerke Ges. June 2nd, 1920. (164,332.)
16,736. "Electric bed warmer." Dr. H. Guggenbuhl. September 7th, 1920. (168,856.)
16,738. "Rotary high-tension electrical machines with oil bath." K. Kando. June 10th, 1918. (165,046.)
25,248. "Process for electrical gas purification." Lodge Fume Co., Ltd. (Metallbank und Metallurgische Ges.). September 23rd, 1921. (177,117.)
25,284. "Electric switches." H. Spengler et E. Chenu. September 23rd, 1920. (169,459.)
27,674. "Stand for electric irons." W. Hodgson. October 29th, 1920. (170,844.)